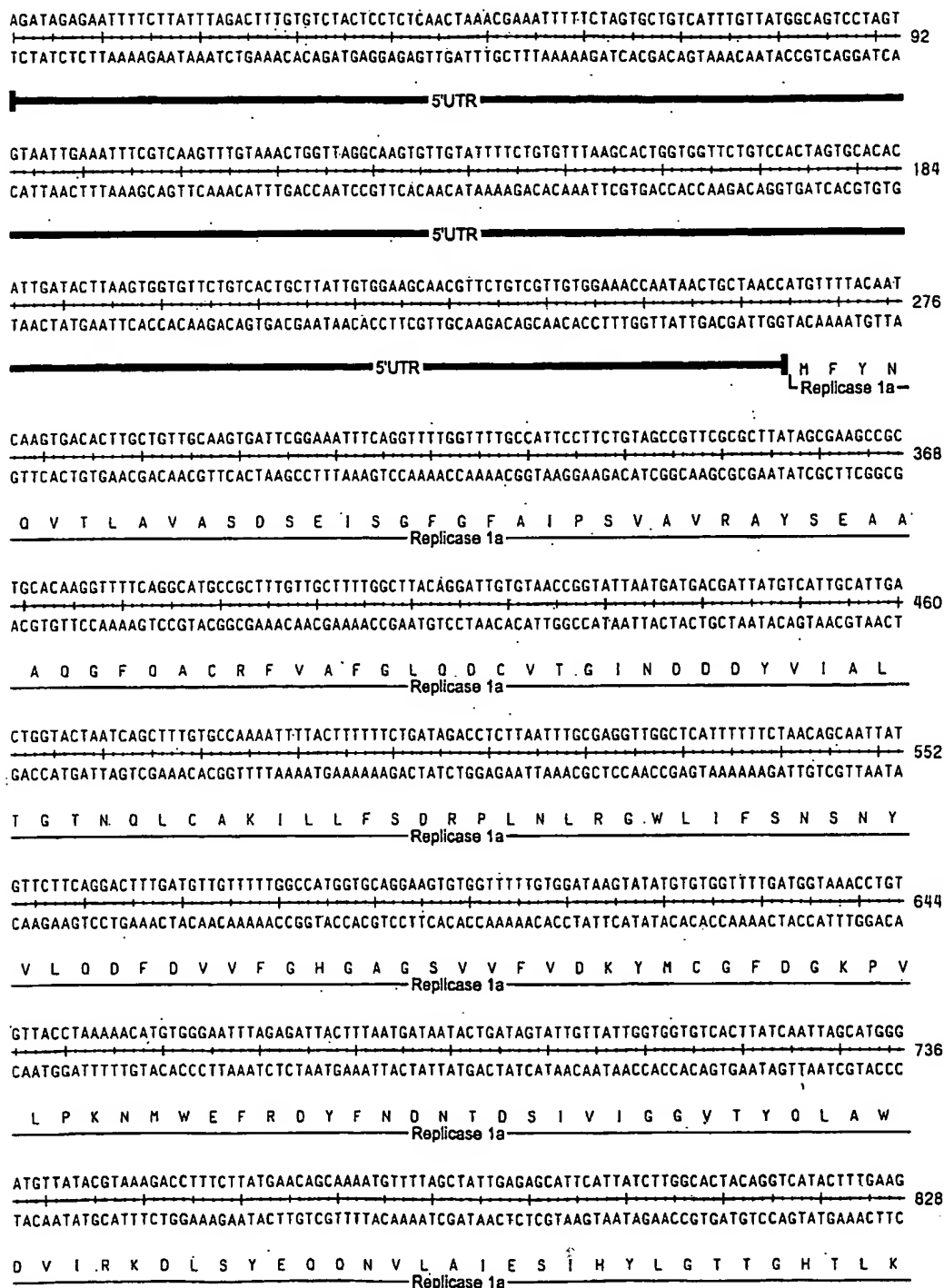


Fig. 1



BEST AVAILABLE COPY

TCTGGTTGCAAACTCATTAAATGCCAAGCCGCTAAATATTTCTTAAGGTTGTTTTGAGTGGTGAATGGAATGCTGTGTATAAGGCGTTTGG
AGACCAACGTTTGGTAATTACGGTTTCGGCGGATTTATAAGAAGATTCCAACAAAACCTACCACCTTACCTTACGACACATATTCGCAAAACC 920
S G C K L I N A K P P K Y S S K V V L S G E W N A V Y K A F G
Replicase 1a

TTCAACATTTATTACAAATGGTATATCATTGCTAGATATAATTGTTAAACAGTTTTCTTTAATGCTTTTGTAAATGCAATTGTGGTTCTG
AAGTGGTAAATAATGTTTACCATATAGTAACGATCTATATTAACAATTTGGTCAAAAGAAATTACGAAAACAATTTACGTTAACACCAAGAC 1012
S P F I T N G I S L L D I I V K P V F F N A F V K C N C G S
Replicase 1a

AGAATTGGAGTGTGGTGCATGGGATGGTTATCTTCTTGTGTGGCACACCTGCTAAGAACTTTGTGTTGTTCTCGGTAATGTTGTT
TCTTAACCTCACAACCACGTACCCTACCAATAGATAGAAGAACACCGTGTGGACGATTCTTTGAAACACAACAAGGACCATTACAACA 1104
E N W S V G A W D G Y L S S C C G T P A K K L C V V P G N V V
Replicase 1a

CCTGGTGTGTGATCATCACCTCAACTGATGCTGGTTGTGGTGTAAATACTATGCTGGCTTAGTTGTTAAACATATTACTAACATTACTGG
GGACCACTACAC TAGTAGTGGAGTTGACTACGACCAACACCACAATTTATGATACGACCGAATCAACAATTTGTATAATGATTGAATGACC 1196
P G D V I I T S T D A G C G V K Y Y A G L V V K H I T N I T G
Replicase 1a

TGTGCTTTATGGCGTGTACAGCTGTTTCTGATGGAATGTTGTGGCAACATCTTCTTATGATGCACCTTTGCAATAGAAATTCATTAG
ACACAGAAATACGACACAATGTCGACAAGTAAGACTACCTTACAACACCGTGTAGAGAATACTACGTGAAAACGTATCTTTAAGTAATC 1288
V S L W R V T A V H S D G M F V A T S S Y D A L L H R N S L
Replicase 1a

ACCCTTTTGCTTTGATGTTAACTTTTCTAATCAATTACGTCTAGCTTTTCTTGGTGTCTGTTACAGAAGATGTTAAATTTGCT
TGGGAAAAACGAACTACAATTTGTAATGAAAGATAGTTAATGCAGATCGAAAAGAACCGAAGACAATGTCTTCTACAATTTAAACGA 1380
D P F C F D V N T L L S N Q L R L A F L G A S V T E D V K F A
Replicase 1a

GCTAGCACTGGTGTATTGACATTAGTGGTATGTTTGGTCTTACGATGACATATTGACAAACAATAAACCTTGGTTTGTACGCAAAAGC
CGATCGTGACCACAATAACTGTAATCACGACCATACAAACGAGAAATGCTACTGTATAACTGTTTGTATTGGAACCAACATGCGTTTCG 1472
A S T G V I D I S A G M F G L Y D D I L T N N K P W F V R K A
Replicase 1a

TTCTGGGCTTTTGTGCAATCTGGGATGCTTTTGTGGCGCTATTAAGCTTGTGCCAACTACTACTGGTGGTTGGTTAGGTTTGTAAAGT
AAGACCGAAAAACTACGTTAGACCTACGAAAACAACGGCGATAATTCGAACACGGTTGATGATGACCACCAACCAATCCAACAATTCA 1564
S G L F D A I W D A F V A A I K L V P T T T G G L V R F V K
Replicase 1a

CTATCGTTCAACTGTTTTAACTGTTTCTAATGGTGTATTATTATGTGTGCGAGATGTTCCAGATGCTTTTCAACCAGTTTACCGCACATTT
GATAGCGAAGTTGACAAAATTGACAAAGATTACCACAATAATAACACACGTCTACAAGGTCTACGAAAAGTTGGTCAATGGCGTGTAAG 1656
S I A S T V L T V S N G V I I M C A D V P D A F O P V Y R T F
Replicase 1a

TTAAAACTCTTAAGCTTACACTTACTTCTAATGGTCTTTTAGGTAATTGTGCCAAACGTTTGTAGACGTGTTTGGTAAAAATTGCTTGATGT 2576
AATTTTGGAGAATTCGAATGTGAATGAAGATTACCAGAAAATCCATTAACACGGTTTGCAAAATCTGCACAAAACCATTTTAACGAACATA
L K T L K L T L T S N G L L G N C A K R F R R V L V K L L D V
Replicase 1a

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GATATTACCAAAAGAACTTTGACAGACATCACAGCATGTGTGACGACCACAAACGTAATTATAATACGACAATTACAAGGTATACATCAAT
Y N G F L E T V C S V V H T A G V C I K Y X A V N V P Y V V
Replicase 1a

TTAGTGGTTTTGTAAGTCGTGAATTCGTAGAGAAAGGTGTGACGTGACTTTTCTTGTGTTAGTTGTGTCACTTTTTCTATGAATTTTTA 2760
AATCACCAAAACATTCAGCACATTAAGCATCTCTTTCCACACTGCCTGAAAAGGAACACAATCAACACAGTGAAAAAGATACTTAAAAAT
I S G F V S R V I R R E R C D V T F P C V S C V T F F Y E F L
Replicase 1a

GACACGTGTTTTGGTGTAGTAAACCTAATGCCATTGATGTTGAACATTTAGAGCTTAAAGAACTGTTTTGTTGAACCTAAGGATGGTGG 2852
CTGTGCACAAAACCAATCATTTGGATTACGGTAACATACTTGAATCTCGAATTTCTTGTACAAAACCACTGGATTCCTACCACC
D T C F G V S K P N A I D V E H L E L K E T V F V E P K D G G
Replicase 1a

TCAATTTTTGTTTCTGATGATTATCTTTGGTATGTTGTAGATGACATTTATTATCCAGCTTCATGTAATGGTGTATTGCCAGTTGCTTTTA 2944
AGTTAAAAACAAGACTACTAATAGAAACCATAACAATCTACTGTAATAATAGGTCGAAGTACATTACCACATAACGGTCAACGAAAAT
O F F V S D D Y L W Y V V D D I Y Y P A S C N G V L P V A F
Replicase 1a

CAAAATGGCAGGTGGTAAAAATATCTTTTCTGATGATGTTATAGTTTCATGATGTTGAACCTACCCATAAAGTCAAGCTCATATTGAGTTT 3036
GTTTAAACCGTCCACCATTTTATAGAAAAGACTACTACAATATCAAGTACTACAACCTGGATGGGTATTTCAGTTCGAGTATAAATCAAA
T K L A G G K I S F S D D V I V H D V E P T H K V K L I F E F
Replicase 1a

GAAGATGATGTTGTACCAGTCTTTGTAAGAAGAGTTTTGGTAAGTCTATTATTTATACAGGTGATTGGGAAGGTTTACATGAAGTTCTTAC 3128
CTTCTACTACAACAATGGTCAGAAACATCTCTCAAACCATTCAGATAATAAATATGTCCACTAACCTTCCAAATGTACTTCAAGAATG
E D D V V T S L C K K S F G K S I I Y T G D W E G L H E V L T
Replicase 1a

ATCTGCAATGAATGTCATTGGGCAACATATTAAGTTGCCACAATTTTATATTATGATGAAGAGGGTGGTTATGATGTTTCTAAACAGTTA 3220
TAGACGTTACTTACAGTAACCCGTTGTATAATTCAACGGTGTAAATATAAATACTACTTCTCCCACTAATACTACAAGATTGGTCAAT
S A M N V I G O H I K L P O F Y I Y D E E G G Y D V S K P V
Replicase 1a

TGATTTACAATGGCCTATTAGTGATGATAGTGATGGTTGTGTGTTGAAGCGAGCACTGATTTTCATCAATTAGAATCTGTTAGAGAAGAG 3312
ACTAAAGTGTACCGGATAATCACTACTATCACTACCAACACAACAACCTCGCTCGTGACTAAAAGTAGTTAATCTTAGACAATCTCTTCTC
M I S O W P I S D D S D G C V V E A S T O F H O L E S V R E E
Replicase 1a

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CAACTATATTAACCTTGTGGAAAACCCCTTCAACTTGACGCGAGAGTTAATCTGTTGGAAAAAGAAAAGAAATCTCTACTTAACCCACA
V D I I E O P F G E V E H A L S I R O P F S F S F R D E L G V
Replicase 1a

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AGCACAAAATCTAGTTAGACTATTATTAACAACCTAATCATGGTGTGAATATGTCAACGT.TGAATGTTTCGAAAACCTACTAAGATAACTCT
R V L D O S D N N C W I S T T L I Q L O L T K L L D D S I E
Replicase 1a

TGCAATTGTTTAAAGTTGGTAAAGTTGATTCAATTGTTCAAAGTGTATGAGTTGTCTCATTTAATTAGTGGTTCACCTGGTGATAGTGGT 3588
ACGTTAAACAAATTCACCATTTCAACTAAGTTAACAAGTTTTCACAATACTCAACAGAGTAAATTAATCACCAGTGAACCACTATCACCA
M O L F K V G K V D S I V O K C Y E L S H L I S G S L G D S G
Replicase 1a

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K L L S E L L K D K Y T C S I T F E M S C D C G K K F D E O V
Replicase 1a

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G C L F W I M P Y T K L F O K G E C C I C H K M O T Y K L V
Replicase 1a

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S M K G T G V F V O D P A P I D I D A F P V R P I C S S V Y L
Replicase 1a

GGTGTAAAGGTTCTGGTCATTATCAACAAATTTATACAGTTTGCACAAAGCTATTGATGGTTTTGGTGTCTTTGACATTAAAAATAGTAG 3956
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Replicase 1a

TGTTAATACTGTTTGTGTTGTTGATGTTGATTTTCATAGTGTAAGAAATAGAAGCTGGTGAAGTTAAACCTTTTGCTGTATATAAAATGTTA 4048
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V N T V C F V D V D F H S V E I E A G E V K P F A V Y K N V
Replicase 1a

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K F Y L G D I S H L V N C V S F D F V V N A A N E N L M H G G
Replicase 1a

GGTGTGCGACGTGCTATTGATATTTGACTGAAGGTCAACTTCAGTCATTATCTAAAGATTACATTAGTAGTAATGGTCCACTTAAGGTTGG 4232
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G V A R A I D I L T E G O L Q S L S K D Y I S S N G P L K V G
Replicase 1a

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A G V M L E C E K F N V F N V V G P R T G K H E H S L L V E
Replicase 1a

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GAATATTAAGATAAAATAAATTTTACCATAAGGTGAATACGGAGAAGAATCAACACCATAAAACCACATTCCTAACCTTTAAGAGAATTT
A Y N S I L F E N G I P L M P L L S C G I F G V R I E N S L K
Replicase 1a

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CGAAACAAATCAACACTGTAATTATTTGGTAACGTTCAAAACAATAAGAAGTTTACTTCTGTTGACAGAAGTCAAAATCTACCAAA
A L F S C D I N K P L Q V F V Y S S N E E Q A V L K F L D G L
Replicase 1a

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TCTAAATGTGGTCAGTAACGCTACAACACTACAACAATTTGAAATCTCAACTTCCATTAAGTAAGAACTAACACCACAGTTACGGA
D L T P V I D D V D V V K P F R V E G N F S F F D C G V N A
Replicase 1a

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ACCTACCCTATAAATGAATAAATAATGATTGAGATAAAATTACAACCTATTTGTTCTGTTAATAACCTGTGTTTTGAATTACCATAAAAC
L D G D I Y L L F T N S I L M L D K O G O L L D T K L N G I L
Replicase 1a

CAACAGGCAGTTCTTGATTATCTTGCTACAGTTAAACTGTACCAGCTGGTAATTTGGTTAACTTGTGTTGAGAGTTGTACCATTATAT 4784
GTTGTCGTCAGAACTAATAGAACGATGCAATTTGACATGGTCGACCATTAAACCAATTGAACAACAACCTCTCAACATGTAATATA
Q Q A V L D Y L A T V K T V P A G N L V K L V V E S C T I Y M
Replicase 1a

GTGTGTTGTACCATCGATAAATGATCTTTCTTTGATAAAATCTTGGTCGTTGTGTCGTAACCTTAATAGATTGAAAACCTTGTGTTATTG 4876
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C V V P S I N D L S F D K N L G R C V R K L N R L K T C V I
Replicase 1a

CCAATGTTCTGCTATTGATGTTTTGAAAAAGCTTTCTTCAAGTTGACTTTAACTGTTAAATTTGTTGAGAGTAATGTTATGGATGTT 4968
GGTTACAAGGACGATAACTACAAAACCTTTTGAAGAAAGTTCAAAGTGAATTTGACAATTTAAACAACATCTCTCATTACAATACCTACAA
A N V P A I D V L K K L L S S L T L T V K F V V E S N V M D V
Replicase 1a

AACGACTGTTTTAAGATGATAATGTAGTTTTGAAAATTACTGAAGATGGTATTAAATGTTAAAGATGTTGTTGTTGAGTCTTCTAAGTCACT 5080
TTGCTGACAAAATCTTACTATTACATCAAACTTTTAATGACTTCTACCATAATTACAATTTCTACAACAACAACCTCAGAAGATTCAGTGA
N D C F K N D N V V L K I T E D G I N V K D V V V E S S K S L
Replicase 1a

TGGTAAACAATTGGGTGTTGTGAGTGATGGTGTGACTCTTTTGAAGGTGTTTTACCTATTAATACTGATACTGTCTTATCTGTAGTCCAG 5152
ACCATTTGTTAACCACAACTCACTACCACAACCTGAGAAAACCTCCACAAAATGGATAATTATGACTATGACAGAATAGACATCGAGGTC
G K O L G V V S D G V D S F E G V L P I N T D T V L S V A P
Replicase 1a

AAGTTGACTGGGTGCTTTTTACGGTTTTGAAAAGGCAGCACTTTTTGCTTCTTTGGATGTAAAGCCATATGGTTACCTAATGATTTTGT 5244
TTCAACTGACCCACGAAAATGCCAAAACCTTTCCGTCGTGAAAAACGAGAAACCTACATTTCCGTATACCAATGGGATTACTAAAACAA
E V D W V A F Y G F E K A A L F A S L D V K P Y G Y P N D F V
Replicase 1a

GGTGGTTTTAGAGTCTTGGGACCCGACAATAATTGTTGGGTAAATGCAACTTGATAATTTACAGTATCTTAAGCCTACTTTTAAATC 5336
CCACCAAAATCTCAAGAACCTGGTGGCTGTTATTAACAACCAATTACGTGAACATATTAAAATGTCATAGAATCGGATGAAAATTTAG
G G F R V L G T T D N N C W V N A T C I I L Q Y L K P T F K S
Replicase 1a

TAAGGGTTTAAATGTTCTTTGGAACAAATTTGTACAGGTGATGTTGGACCTTTTGTAGTTTTATTATTTTATAACTATGCTTCAAAGG 5428
ATCCCAAAATTTACAAGAACCTGTTTAAACAATGTCCACTACAACCTGGAACCAATCAAAATAAATAAAATATTGATACAGAAGTTTCC
K G L N V L W N K F V T G D V G P F V S F I Y F I T M S S K
Replicase 1a

GTCAAAAGGGTGATGCTGAAGAGGCATTATCTAAATTGTCAGAGTATTTGATTAGTATTCTATTGTTACTCTTGAACAATATTCAACTGT 5520
CAGTTTTCCCACTACGACTTCTCCGTAATAGATTTAACAGTCTCATAAACTAATCACTAAGATAACAATGAGAACTGTTATAAGTTGAACA
G O K G D A E E A L S K L S E Y L I S D S I V T L E Q Y S T C
Replicase 1a

GACATTTGTAAGTACTGTAGTTGAAGTTAAAGTGCTGTTGTCTGTGCTAGTGTCTTAAAGATGGTTGTGATGTTGGTTTTGTCCACA 5612
CTGTAACATTTTCATGACATCAACTTCAATTTTCACGACAACAGACACGATCACACGAATTTCTACCAACACTACAACCAAAACAGGTGT
D I C K S T V V E V K S A V V C A S V L K D G C D V G F C P H
Replicase 1a

CAGACATAAATTGCGTTCACGTGTTAAGTTTGTAAATGGACGTGTTGTTATTACCAATGTTGGTGAACCTATAATTCACAACCTTCTAAGT 5704
GTCTGATTTAACGCAAGTGCACAATTCAACAATTACCTGCACAACAATAATGGTTACAACCACTTGGATATTAAAGTGTGGAAGATTCA
R H K L R S R V K F V N G R V V I T N V G E P I I S O P S K
Replicase 1a

TGCTTAATGGTATTGCTTATACAACATTTTCAGGTCTTTTGATAACGGTCACTATGTAGTTTATGATGCTGCTAATAATGCTGTCTATGAT 5796
ACGAATTACCATAACGAATATGTTGTAAGTCCAAGAAAACCTATTGCCAGTGATACATCAATACTACGACGATTATTACGACAGATACTA
L L N G I A Y T T F S G S F O N G H Y V V Y D A A N N A V Y D
Replicase 1a

GGTGCTCGTTATTTGCTTCAGATTTGTCTACTTTAGCTGTTACAGCTATTGTTGTAGTAGGTGGTTGTGAACATCTAATGTTCCACCAAT 5888
CCACGAGCAAATAAACGAAGTCTAAACAGATGAAATCGACAATGTCGATAACAACATCATCCACCAACACATTGTAGATTACAAGTGTTA
G A R L F A S D L S T L A V T A I V V V G G C V T S N V P P I
Replicase 1a

TGTTAGTGAGAAAATTTCTGTTATGGATAAACTTGATACTGGTGCACAAAAATTTTCCAATTTGGTGATTTTGTATGAATAACATTGTTTC 5980
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V S E K I S V M D K L D T G A Q K F F O F G D F V M N N I V
Replicase 1a

TGTTTTAACTGGTGTCTAGTATGTTTAGTCTTTACGTACTTCTATTATGAAGCATGATATTAAAGTTATTGCCAAGGCTCCATAACGT 6072
ACAAAAATGAACCAACGAATCATACAAATCAGAAAATGCATGAAGATAATACITTCGTACTATAATTCAATAACGGTTCGAGGATTGCA
L F L T W L L S M F S L L R T S I M K H D I K V I A K A P K R
Replicase 1a

ACAGGTGTTATTTTGACACGTAGTTTTAAGTATAACATTAGATCTGCTTTGTTTGTGTAAGCAGAAGTGGTGTGTTATTGTTACTTTGTT 6164
TGCCACAATAAACTGTGCATCAAAATTCATATTGAATCTAGACGAACAAACAACATTCGTCTTCACCACACAATAACAATGAACAA
T G V I L T R S F K Y N I R S A L F V V K Q K W C V I V T L F
Replicase 1a

TAAGTCTTATTGTTATTATATGCTATTTATGCACTTGTTTTATGATTGTGCAATTTAGTCTTTTAAAGTCTTTTATGTTGGTGACATTG 6256
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K F L L L L Y A I Y A L V F H I V Q F S P F N S L L C G D I
Replicase 1a

TAAGTGGTTATGAAAAATCCACTTTTAAATAAGGATATTTATTGGTAAATCTATGGTTTGAAGATGTGTTTGTATTAGTTATCAAGAGTTT 6348
ATTCACCAATACTTTTATGGTGAATTTATCTATAAATAACACCATTAAGATACCAAAACATTCTACACAAACAATCAATAGTTCTCAAA
V S G Y E K S T F N K D I Y C G N S M V C K M C L F S Y Q E F
Replicase 1a

AATGATTGGATCATACTAGTCTTTGTTTGAAGCACATTCGTGATCCTATTAATCAGTTTACAAACATTTGTTATCTTGTATTATTTGTT 6440
TTACTAAACCTAGTATGATCAGAACAACCTTCGTGAAGCACTAGGATATAATTAGTCAAAATGTTGGTAAACAATATGAACAATAAAACAA
N D L D H T S L V W K H I R D P I L I S L Q P F V I L V I L L
Replicase 1a

AATTTTGGTAAATATGTTTTCGCTTTTGGACTTTTATATTTTGTGCACAATTTATTAGTACTTTTGGTCTTTCTTAGGCTTTTCATCAGA 6532
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I F G N M Y L R F G L L Y F V A O F I S T F G S F L G F H O
Replicase 1a

AACAGTGGTTTTACATTTTGTGCCGTTTGATGTTTTATGTAATGAGTTTTAGTCTACATTTATTGCTGCAAAATGTTTTATTGTTAGA 6624
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K Q W F L H F V P F D V L C N E F L A T F I V C K I V L F V R
Replicase 1a

CATATTATTGTTGGCTGTAATAATGCTGACTGTGTAGCTTGTCTAAAAGTGCTAGACTTAAACGTGTACCACTTCAAACCTATTATTAATGG 6916
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H I I V G C N N A D C V A C S K S A R L K R V P L Q T I I N G
Replicase 1a

TATGCATAAATCATTCTATGTTAATGCTAATGGTGGTACTTGTCTGTAATAAACATAACTTCTTTGTGTTAATTGTGATTCCTTTGGGC 6808
ATACGTATTAGTAAGATACAATTACGATTACCACCATGAACAAAGACATTATTGTATTGAAGAAAACACAATTAACACTAAGAAAACCCG
M H K S F Y V N A N G G T C F C N K H N F F C V N C D S F G
Replicase 1a

CTGGTAATACTTTTATTAATGGTGATTTGCAAGAGAGCTTGGTAATGTTGTTAAACAGCTGTTCAACCCACAGCTCCTGCATATGTTATT 6900
GACCATTATGAAAATAATTACCATAAAGCTTCTCTCGAACCATTACAACAATTTTGTGACAAGTTGGGTGTCGAGGACGTATACAATAA
P G N T F I N G D I A R E L G N V V K T A V Q P T A P A Y V I
Replicase 1a

ATTGATAAGGTAGATTTTGTAAATGGATTTTATCGTCTTTATAGTGGTGACACTTTTGGCGGTATGACTTTGACATTACTGAATCTAAGTA 6992
TAACTATTCCATCTAAACAATTACCTAAAATAGCAGAAATATCACCAGTGTGAAAAACGCCATCTGAAACTGTAATGACTTAGATTCAT
I D K V D F V N G F Y R L Y S G D T F W R Y D F D I T E S K Y
Replicase 1a

TAGTTGTAAGAGGTTCTGAAGAATTGTAATGTTTTAGAAAATTTTATTGTTTACAATAATAGTGGTAGTAACATTACACAGATTAAAAATG 7084
ATCAACATTTCTCAAGACTTCTTAAACATTACAAAATCTTTAAAAATAACAATGTTATTATCACCATCATTGTAATGTGTCTAATTTTAC
S C K E V L K N C N V L E N F I V Y N N S G S N I T Q I K N
Replicase 1a

CTTGTGTTTATTTTCTCAATGTTGTGTGAACCTATAAAGTTGGTAAATTCAGAGTTGTTGTCAACTTTATCAGTTGATTTTAAATGGTGT 7176
GAACACAAATAAAAAGAGTTAAACACACACTTGGATATTCAACCTTTAAGTCTCAACAACAGTTGAAATAGTCAACTAAAATTACCACAA
A C V Y F S O L L C E P I K L V N S E L L S T L S V D F N G V
Replicase 1a

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AACGTATTCCGTATACAACACAAACACATTATCAAAAAATTCCTCGATTGACGATTGTACAGGTACCGACTTACATTTTCGATGTGAACC
L H K A Y V D V L C N S F F K E L T A N M S M A E C K A T L G
Replicase 1a

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L T V S O D D F V S A V A N A H R Y D V L L S O L S F N N F
Replicase 1a

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F I S Y A K P E D K L S V Y D I A C C M R A G S K V V N H N V
Replicase 1a

TTAATCAAAGAGTCAATACCTATTGTTTGGGGTGCAAGGACTTTAATACTCTTCTCAAGAAGGTAAGAAGTACCTTGTTAAACAACATAA 7544
AATTAGTTTCTCAGTTATGGATAACAAACCCACAGTTCCTGAAATTATGAGAAAGATTCTTCCATTCTTCATGGAACAATTTGTGATT
L I K E S I P I V W G V K D F N T L S O E G K K Y L V K T T K
Replicase 1a

AGCAAAGGGTTTGACTTTTTTATTAACTTTAAATGATAACCAAGCAATTACACAAGTTCCTGCTACTAGTATAGTTGCAAACAGGGTGCTG 7636
TCGTTTCCAAACTGAAAAATAATTGAAATTACTATTGGTTCGTTAATGTGTTCAAGGACGATGATCATATCAACGTTTGTCCACGAC
A K G L T F L L T F N D N Q A I T O V P A T S I V A K Q G A
Replicase 1a

GTTTTAAACGTACTTATAATTTCTGTGGTATGTATGTTTATTTGTTGTGCAATTGTTTATTGGTGTCTCATTTATTGATTATACAACCACT 7728
CAAAATTTGCATGAATATTAAGACACCATACATAAATAACAACAGTAACAATAAACCACAGAGTAAATACTAATATGTTGGTGA
G F K R T Y N F L W Y V C L F V V A L F I G V S F I D Y T T T
Replicase 1a

GTAAGTAGCTTTCATGGTTATGATTTTAAAGTACATTGAGAATGGTCAGTTGAAGGTGTTGAAGCACCTTTACACTGTGTTGTAATGTTTT 7820
CATTGATCGAAAGTACCAATACTAAATTCATGTAACCTTACCAGTCAACTTCCACAACTTCGTGGAATGTGACACAAGCATTACAAA
V T S F H G Y D F K Y I E N G O L K V F E A P L H C V R N V F
Replicase 1a

TGATAATTTAATCAATGGCATGAGGCTAAGTTTGGTGTGTTACTACTAATAGTGATAAATGTCCTATAGTTGTTGGTGTTCAGAGCGTA 7912
ACTATTAATAATTAGTTACCGTACTCCGATTCAAACCAACAATGATGATTATCACTATTTACAGGATATCAACAACCAACAAGTCTCGCAT
D N F N O W H E A K F G V V T T N S D K C P I V V G V S E R
Replicase 1a

TTAATGTTGTTCTGGTGTTCACAAATGTATATTTGGTAGGAAAGACTCTTGTGTTTACATTACAGGCTGCTTTTGGAAACACAGGTGT 8004
AATTACAACAAGGACCACAAGGTGTTTACATATAAACCATCTTTCTGAGAACAAAATGTAATGTCGACGAAAACCTTTGTGCCACAA
I N V V P G V P T N V Y L V G K T L V F T L O A A F G N T G V
Replicase 1a

TGTTATGACTTTGATGGTGTACCACTAGTGATAAGTGATTTTTAATCTGCTTGCTAGGTTGGAAGGTTTGGGTGGTGACAAATGTTTA 8096
ACAATACTGAAACTACCACAATGGTGATCACTATTCATATAAAATTAAGACGAACATGATCCAACCTTCCAACCCACCACTGTTACAAAT
C Y D F D G V T T S D K C I F N S A C T R L E G L G G D N V Y
Replicase 1a

TGTTACAACACTGATCTTATTGAAGGTCTAAACCTTATAGTATTTTACAGCCCAATGCTTATTATAAGTATGATGTTAAAAATTATGTAC 8188
ACAATGTTGTGACTAGAATAACTTCCAAGATTGGAATATCATAAATGTCGGGTACGAATAATTCATACTACAATTTTAAATACATG
C Y N T D L I E G S K P Y S I L O P N A Y Y K Y D V K N Y V
Replicase 1a

GTTTCCAGAAATTTAGCTAGAGGTTTGGCTTACGTACTATTAGAACCTTTGGCTACACGTTATTGTAGAGTTGGTGAATGCCGTGACTCA 8280
CAAAAGGTCTTTAAATCGATCTCCAAACCGAATGCATGATAATCTTGAACCGATGTGCAATAACATCTCAACCACTTACGGCACTGAGT
R F P E I L A R G F G L R T I R T L A T R Y C R V G E C R D S
Replicase 1a

CATAAAGGTGTTTGGTTTGGTAAATGGTATGTAATGATGGACGTGTTGATGACGGTTACATTGTGGTGATGGTCTTATAGACCT 8372
GTATTTCCACAAACAAACCAAACTATTTACCATACAATTACTACCTGCACAACACTGCGCAATGTAAACACCACTACCAGAAATATCTGGA
H K G V C F G F D K W Y V N D G R V D D G Y I C G D G L I D L
Replicase 1a

TCTTGTAATGACTCTCAATCTTTAGTTCATCTTTAGCGTTGTGGCTATGCTGGACATATGTTGTTAATTTCTTTTGCAGCATTTA 8464
AGAACAATTACATGACAGTTAGAAATCAAGTAGAAAATCGCAACCCGATACAGACCTGTATACAACAAATTAAGAAAAACGTCGTAAT
L V N V L S I F S S S F S V V A M S G H M L F N F L F A A F
Replicase 1a

TTACATTTTGTGCTTTTGTACTAAATTTAAACGTGTTTTGGTGATCTTCTTATGGTGTGTTTACGTGTTGTTGCAACTTTGATT 8556
AATGTAAAAACACGAAAAATCAATGATTTAAATTTGCACAAAACCACTAGAAAGAATACCACAAAATGACAACAAACACGTTGAACTAA
I T F L C F L V T K F K R V F G D L S Y G V F T V V C A T L I
Replicase 1a

AATAACATTTCTTATGTTGTTACTCAAAATTTATTTTTATGTTGCTTTATGCTATTTGTATTTGTTTTACTAGGACAGTGGCTTATGC 8648
TTATTGTAAGAATACAACATGAGTTTAAATAAAAAATACAACGAAATACGATAAAACATAAAACAAAATGATCCTGTACGCAATACG
N N I S Y V V T O N L F F M L L Y A I L Y F V F T R T V R Y A
Replicase 1a

TTGGATTGGCATATTGCATACATTGTCATCTTCTGTTAATACCATGGTGGCTTCTCATGTTTGTGTTTGTGTCATTTTGTAGGC 8740
AACCTAAACCGTATAACGTATGTAACAACGTATGAAGAACAATTATGTTACCCGAAGAGGTACCAAATCAAACGACGTAAAAATCTCG
W I W H I A Y I V A Y F L L I P W W L L T W F S F A A F L E
Replicase 1a

TTTACCTAATGTTTTAAGTTAAAACTCTACTCAATTGTTGAAGGTGATAAGTTTATAGGTACTTTGAGAGTGCTGCTGCAGGTACA 8832
AAAATGGATTACAAAATTCATTTTGTAGATGAGTTAACAACCTCCACTATTCAAATATCCATGAAAACCTCTCAGCAGCAGTCCATGT
L L P N V F K L K I S T O L F E G D K F I G T F E S A A A G T
Replicase 1a

TTTGTCTTGACATGCGTTCTTATGAAAGGCTGATAAATACTATTTACCTGAGAACTTAAGAATTATGCTGCAAGTTATAATAATATAA 8924
AAACAAGAACTGTACGCAAGAATACTTTCCGACTATTTATGATAAAGTGGACTCTTTGAATCTTAATACGACGTTCAATATTATTATTT
F V L D M R S Y E R L I N T I S P E K L K N Y A A S Y N K Y K
Replicase 1a

ATATTATAGTGGTAGTGCTAGTGAGGCTGATTATCGTTGTGCTTGTATGCTCATTAGCCAAGGCTATGTTAGATTACGCAAAAGATCATA 9016
TATAATATCACCATCAGGATCACTCCGACTAATAGCAACACGAACATACGAGTAAATCGGTTCCGATACAATCTAATCGGTTTCTAGTAT
Y Y S G S A S E A D Y R C A C Y A H L A K A M L D Y A K D H
Replicase 1a

ATGACATGTTATATTCTCCACCTACCATTAGCTACAATTCACCTTACAATCTGGTCTTAAGAAGATGGCACAACCATCTGGTTGTGTTGAG 9108
TACTGTACAATATAAGAGGTGGATGGAATCGATGTTAAGGTGGAATGTTAGACCAGAATCTTCTACCGTGTGGTAGACCAACACAACCTC
N D M L Y S P P T I S Y N S T L O S G L K K M A O P S G C V E
Replicase 1a

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AGATGTGTGGTTCGGCTCTGTTATGGTAGTCTGTGCTTAATGGAGTTTGGTTAGGTGACACTGTTACTTGTCTAGACATGTCATAGCACC 9200
TCTACACCAAGCGCAGACAATACCATCATGACACGAATTACCTCAAACCAATCCACTGTGACAATGAACAGGATCTGTACAGTATCGTGG
R C V V R V C Y G S T V L N G V W L G D T V T C P R H V I A P
Replicase 1a

ATCAACCACTGTTCTTATTGATTATGATCATGCATATAGTACTATGCGTTTGCATAATTTTTCAGTGTCTCATAATGGTGTCTTCTTGGGAG 9292
TAGTTGGTGACAAGAATAACTAATACTAGTACGTATATCATGATACGCAACGTATTAAGAGTCACAGAGTATTACCACAGAAGAACCCTC
S T T V L I D Y D H A Y S T H R L H N F S V S H N G V F L G
Replicase 1a

TTGTTGGTGTACAATGCATGGTCTGTGTTGCGTATTAAGGTTTCACAATCTAATGTACATACACCTAAACATGTTTTTAAACGTTGAAA 9384
AACCAACCAATGTTACGTACCAAGACACAACGCATAATCCAAAGTGTAGATTACATGTATGTGGATTGTACAAAATTTGCAACTTT
V V G V T H H G S V L R I K V S O S N V H T P K H V F K T L K
Replicase 1a

CCTGGTGTCTCTTTAATATTTAGCATGTTATGAAGTATTGCATCTGGTGTGTTTTGGTGTAAATTTACGTACAAACTTTACTATTAAAGG 9476
GGACCACGAAGAAAATTATAAATCGTACAATACTTCCATAACGTAGACCACAAAACCACAATTAATGCATGTTGAAATGATAATTCC
P G A S F N I L A C Y E G I A S G V F G V N L R T N F T I K G
Replicase 1a

TTCTTTTATAAATGGAGCTTGTGGTCTCCTGGTTATAATGTTAGAAATGATGGTACTGTTGAGTTTGTATTATTACACCAAAATGAGTTAG 9568
AAGAAAATATTACCTCGAACCAAGAGGACCAATATTACAATCTTTACTACCATGACAACCTCAAAACAATAAATGTGGTTAACTCAATC
S F I N G A C G S P G Y N V R N D G T V E F C Y L H O I E L
Replicase 1a

GTAGTGGTGCTCATGTTGGTCTGATTTTACTGGTAGTGTATGGAATTTTGATGACCAACCTAGTTTGAAGTTGAGAGTGCCACCTT 9660
CATCACCACGAGTACAACCAAGACTAAAATGACCATCACAATACCATTAACCACTGTTGGTGGATCAACGTTCAACTCTCAGGTTGGAA
G S G A H V G S D F T G S V Y G N F D D O P S L O V E S A N L
Replicase 1a

ATGCTATCAGATAATGTTGTTGCCCTTTTGTATGCTGCTTTGTTGAATGGTTGAGGTGGTGGTTCAGTCAACTAGAGTTAATGTTGATGG 9752
TACGATAGTCTATTACAACACGGAACAAATACGACGAAACAACTTACCAACATCCACCACCAACGCAAGTTGATCTCAATTACAACCTAC
M L S D N V V A F L Y A A L L N G C R W W L R S T R V N V D G
Replicase 1a

TTTTAATGAATGGGCTATGGCTAATGGTTATACAATGTTTCTAGTGTGAGTGCTATTCTATTTTGGCAGCAAAAACCTGGTGTAGTGTG 9844
AAAATTACTTACCCGATACCGATTACCAATATGTTAACAAGATCACAACCTCAGATAAGATAAAACCGTCGTTTTGACCACAATCACAAC
F N E W A M A N G Y T I V S S V E C Y S I L A A K T G V S V
Replicase 1a

AACAATGTTAGCTTCCATTCAACATCTTCATGAAGGTTTTGGTGGTAAAAACATACTTGGTTATTCTAGTTTATGTGATGAGTTCACACTA 9936
TTGTTAACAATCGAAGGTAAGTTGTAGAAGTACTTCCAAAACCACTTTTGTATGAACCAATAAGATCAAATACACTACTCAAGTGTGAT
E O L L A S I O H L H E G F G G K N I L G Y S S L C D E F T L
Replicase 1a

GCTGAAGTTGTGAAGCAGATGTATGGTGAACCTGCAAAGTGGTAAGGTTATTTTGGTTTAAAAACAATGTTTTATTAGCGTTTTCTT 10028
CGACTTCAACACCTTCGTCTACATACCACAATTGAACGTTTCACCATTCCAATAAAAAACCAATTTTGTACAAAAATAAATCGCAAAAGAA
A E V V K Q M Y G V N L Q S G K V I F G L K T M F L F S V F F
Replicase 1a

CACAAATGTTTTGGGCAGAATCTTTATTTATACAAACTATATGGATAAACCTGTTATACTTACACCTATATTTTGTCTTACTTTTGTTTT 10120
GTGTTACAAAACCGCTCTTGAGAAATAAATATGTTTGTGATATACCTATTTGGGACAATATGAATGTGGATATAAAACCAATGAAACAAAA
T M F W A E L F I Y T N T I W I N P V I L T P I F C L L L F
Replicase 1a

TGTCATTAGTTTTAACTATGTTTCTTAAACATAAGTTTTGTTTTGCAAGTATTTTATTACCTACTGTTATTGCAACTGCTTTATATAAT 10212
ACAGTAATCAAAATGATACAAAGAATTGTATTCAAAAACAAAACGTTCAATAAATAATGGATGACAATAACGTTGACGAAATATATTA
L S L V L T M F L K H K F L F L Q V F L L P T V I A T A L Y N
Replicase 1a

TGTGTTTTGGATTATTACATAGTAAATTTTTGGCTGACCATTTTAACTATAATGTTTCAGTATTACAAATGGATGTTTCAGGGTTTAGTTAA 10304
ACACAAAACCTAATAATGTATCATTTTAAAAACCGACTGGTAAATGTATTTACAAAGTCATAATGTTTACCTACAAGTCCCAATCAATT
C V L D Y Y I V K F L A D H F N Y N V S V L Q M D V Q G L V N
Replicase 1a

TGTTTTGGTCTGTTTATTTGTTGTATTTTACACACATGGCGTTTTCTAAGAAGCGTTTCACACATTGGTTTACATATGTGTGTTCTCTTA 10396
ACAAAACGAGACAAATAAACACATAAAATGTGTGACCGCAAAAGATTCTTGCAAAGTGTGAACCAATGTATACACACAAGAGAAT
V L V C L F V V F L H T W R F S K E R F T H W F T Y V C S L
Replicase 1a

TAGCAGTTGCTTACACTTATTTTATAGTGGTGACTTTTGAAGTTGCTTGTATGTTTTATGCTATATCTAGTGATTGGTACATTGGT 10488
ATCGTCAACGAATGTGAATAAAATATCACCCTGAAAACTCAACGAACAATACAAAATACACGATATAGTACTAACCATGTAACCA
I A V A Y T Y F Y S G D F L S L L V M F L C A I S S O W Y I G
Replicase 1a

GCCATTGTTTTAGGTTGTCACGTTTGATTATATTTTTTACCTGAAAGTGATTTAGTGTGTTTTGGTGATGTGAACTCACTTTAGTTGT 10580
CGGTAACAAAATCCAACAGTGCAAACTAATAAAAAAGTGACTTTACATAAATCACAAAACCACTACCTTTGAGTGAAATCAACA
A I V F R L S R L I I F F S P E S V F S V F G D V K L T L V V
Replicase 1a

TTATTTAATTTGTGGTTATTTAGTTTGTACTTATTTGGGCATTTTGTATTGGTTCAATAGGTTTTTAAATGTACTATGGGTGTTTATGATT 10672
AATAAATTAACACCAATAAATCAACATGAATAACCCGTAACATAACCAAGTTATCCAAAAATTTACATGATACCCACAATACTAA
Y L I C G Y L V C T Y W G I L Y W F N R F F K C T M G V Y D
Replicase 1a

TTAAGGTGAGTGCTGCTGAATTTAAATACATGTTGCTAATGGACTTCATGCACCATATGGACCTTTTGTGCACTTTGGTTATCATTTCAAA 10764
AATCCACTCACGACGACTTAAATTTATGTACCAACGATTACCTGAAGTACGTGGTATACCTGGAAAACCTGTAACCAATAGTAAGTTT
F K V S A A E F K Y M V A N G L H A P Y G P F D A L W L S F K
Replicase 1a

TTACTTGGTATTGGTGGTGACCGTTGTATAAAATTTCAACTGTCCAATCCAACTGACTGATTGAAGTGACTAATGTTGTGTTATTGGG 10856
AATGAACCATAACCACCACTGGCAACATATTTTAAAGTTGACAGGTTAGGTTTGACTGACTAACTTCACATGATTACAACACAATAACCC
L L G I G G D R C I K I S T V Q S K L T D L K C T N V V L L G
Replicase 1a

TTGTTTGTCTAGTATGAACATTGCAGCTAATTCTAGTGAATGGGCTTATTGTGTTGATTTACACAATAAGATTAATCTTTGTGATGACCCAG 10948
AACAAACAGATCATACTTGTAACTCGATTAAGATCACTTACCGAATAACACAATAAATGTGTTATTCTAATTAGAAACACTACTGGGTC
C L S S M N I A A N S S E W A Y C V D L H N K I N L C D D P
Replicase 1a

AAAAAGCTCAAGGTATGTTGTTAGCACTCCTTGGCTCTTTCTAAGTAAACATAGTGATTTTGGTCTTGATGGCCTTATTGATTCTTATTTT 11040
TTTTTCGAGTTCCATACACAATCGTGAGGAACGCAAGAAAGATTCAATTGTTATCACTAAAACCAAGAACTACCGGAATAACTAAGAATAAAA
E K A O G M L L A L L A F F L S K H S D F G L D G L I D S Y F
Replicase 1a

GATAATAGTAGCACCTGCAGAGTGTGCTTCATCTTTGTTAGTATGCCATCATATATGCTTATGAAAATGCTAGACAAGCTTATGAGGA 11132
CTATTATCATCGTGGGACGCTCACAACGAAGTAGTAAACAATCATACGGTAGTATATAACGAATACTTTTACGATCTGTTTCAATACTCCT
D N S S T L Q S V A S S F V S M P S Y I A Y E N A R Q A Y E D
Replicase 1a

TGCTATTGCTAATGGATCTTCTTCACTTATTAACAATTGAAGCGTGCCATGAATATCGCAAAGTCTGAATTTGATCATGAGATATCTG 11224
ACGATAACGATTACCTAGAAGAAGAGTTGAATAATTTGTTAACTTCGCACGGTACTTATAGCGTTTCAGACTTAACTAGTACTCTATAGAC
A I A N G S S S Q L I K O L K R A M N I A K S E F D H E I S
Replicase 1a

TTCAGAAGAAAATTAATAGAATGGCTGAACAAGCTGCTACTCAGATGTATAAGAAGCAGCTCTGTTAATAGAAAATCTAAAGTTATTAGT 11316
AAGTCTCTTTAATTATCTTACCGACTTGTTCGACGATGAGTCTACATATTTCTTCGTGCGAGACAATTATCTTTAGATTTCATAATCA
V Q K K I N R M A E Q A A T O M Y K E A R S V N R K S K V I S
Replicase 1a

GCTATGCACTCTTTACTTTTTGGAATGTTAAGACGTTTGATATGTCTAGTGTGAACTGTTTTGAATTTAGCACGTGATGGTGTGTGCC 11408
CGATACGTGAGAAATGAAAAACCTTACAATTCTGCAAACTTACAGATCACAACCTTTGACAAAACCTTAAATCGTCACTACCAACAACCGG
A M H S L L F G M L R R L D M S S V E T V L N L A R D G V V P
Replicase 1a

ATTGTCAGTTATACCTGCAACTTCAGCTTCCAACTAATCTTGTAGTCCAGATCTTGAATCTTATTCTAAGATTGTTGTGATGGTTCTG 11500
TAACAGTCAATATGGAGCTGAAGTGAAGGTTGATTGATAACAATCAGGTCTAGAACTAGAATAAGATTCTAACAAACACTACCAAGAC
L S V I P A T S A S K L T I V S P D L E S Y S K I V C D G S
Replicase 1a

TTCATTATGCTGGAGTTGTTTGGACACTTAATGATGTTAAGACAATGATGGTAGACCTGTTTATGTTAAGAGATTACAAGGGAGAATGTT 11592
AAGTAATACGACCTCAACAAACCTGTGAATTACTACAATTTCTGTACTACCATCTGGACAAGTACAATTTCTCTAATGTTCCCTCTTACAA
V H Y A G V V W T L N D V K D N D G R P V H V K E I T R E N V
Replicase 1a

GAAACTTTGACATGGCCTCTTATCCTTAATTGTGAACGTGTTGTTAACTTCAAAATAATGAAATTATGCCTGGTAACTTAAGCAAAACC 11684
CTTTGAAACTGTACCGGAGAATAGGAATTAACACTTGCACAACAATTTGAAGTTTATTACTTTAATACGGACCATTTGAATTCGTTTTGG

E T L T W P L I L N C E R V V K L O N N E I H P G K L K Q K P
Replicase 1a

TATGAAAGCTGAGGGTGATGGTGGTGTITAGGTGATGGTAATGCTTTGTATAATACTGAGGGTGGTAAACTTTTATGTATGCTTATATTT 11776
ATACTTTCGACTCCCACTACCACCACAAAATCCACTACCATTACGAAACATATTATGACTCCCACTTTTGAAAATACATACGAATATAAA

H K A E G D G G V L G D G N A L Y N T E G G K T F M Y A Y I
Replicase 1a

CTAATAAGCTGACCTTAAATTTGTTAAGTGGGAGTATGAGGGTGGTGAACACAATCGAGTTAGACTCTCCTTGTGATTTATGGTCGAA 11868
GATTATTTGACTGGAATTTAAACAATTCACCTCATCTCCCAACAGTTGTGTTAGCTCAATCTGAGAGGAACAGCTAAATACCAGCTT

S N K A D L K F V K W E Y E G G C N T I E L D S P C R F M V E
Replicase 1a

ACACCTAATGGTCTCAAGTGAAGTATTTGTATTTGTTAAAAATTTAAATACCTTACGTAGAGGTGCCGTTCTTGTTTTATAGGTGCCAC 11960
TGTGGATTACCAGGAGTTCACCTCATAAACATAAAACAATTTTAAATTTATGGAATGCATCTCCACGGCAAGAACAAAATATCCACGGTG

T P N G P Q V K Y L Y F V K N L N T L R R G A V L G F I G A T
Replicase 1a

AATTCGTCTACAAGCTGGTAAACAACTGAATTGGCTGTTAATCTGGACTTTTAACTGCTTGTGCTTTTCTGTTGATCCAGCAACCACTT 12052
TTAAGCAGATGTTGACCATTTGTTTGACTTAACCGACAATTAAGACTGAAAATGACGAACACGAAAAGACAAGTGGTGGTGGTGA

I R L O A G K O T E L A V N S G L L T A C A F S V D P A T T
Replicase 1a

ACTTGAAGCTGTTAAACATGGTGCAAAACCTGTAAGTAATGTATTAAGATGTTATCTAATGGTGCTGTAATGGTCAAGCTATAACAAC 12144
TGAACCTTCGACAATTTGTACCACGTTTGGACATTCATTAACATAATTCTACAATAGATTACCACGACCATACCAGTTCGATATTGTTGA

Y L E A V K H G A K P V S N C I K M L S N G A G N G O A I T T
Replicase 1a

AGTGTAGATGCTAACCAATCAAGATTCTTATGGTGGAGCGTCTATTTGTTTGTATTGTGCGGCCACGTTCTCACCTAGTATGGATGG 12236
TCACATCTACGATTGTGGTTAGTTCTAAGAATACCACCTCGCAGATAAACAAACATAACAGCCGGGTGCAAGGAGTGGGATCATACCTACC

S V D A N T N O D S Y G G A S I C L Y C R A H V P H P S M D G
Replicase 1a

TTACTGTAAGTTTAAGGGTAAATGTGTTACGTTCTATTGGTGTGTTGGATCTATTAGGTTTTGTTTAGAAAATAATGTGTGAATGTTT 12328
AATGACATTCAAATTCCTTTACACAAGTCAAGGATAACCAACAACCTAGGATAATCCAAAACAATCTTTTATTACACATTACAAA

Y C K F K G K C V O V P I G C L D P I R F C L E N N V C N V
Replicase 1a

GTGGTTGTTGGTTGGGACACGGGTGCTTGTGATCGTACAACATTCAAAGTGTGACATTTCTTATTTAAACGAGCAAGGGTTCTAGTG
CACCACAACCAACCTGTGCCACACGAACACTAGCATGTTGGTAAGTTTCACAACGTAAAGAATAAATTTGCTCGTTCCCAAGATCAC 12420
C G C W L G H G C A C D R T T I O S V D I S Y L N E O G V L V
Replicase 1a
R A R G S S
Replicase 1b
CAGCTCGACTAGAACCTGTAATGGCACGGACATCGATAAGTGTTCGTGCTTTTGACATTTATAATAAAATGTTTCATTCTTGGTAAG
GTCGAGCTGATCTTGGGACATTACCGTGCTGTAGCTATTACACAAGCACGAAAACGTAAATATTATTTTACAAAGTAAGAACCATTTC 12512
Q L D
-Replicase 1a-
A A R L E P C N G T D I O K C V R A F D I Y N K N V S F L G K
Replicase 1b
TGTTTGAAGATGAACCTGTTCGTTTTAAAAATGCTGATCTTAAGGATGGTTATTTTGTATAAAGAGGTGTAAGTCGGTTATGGAACA
ACAAACTTCTACTTGACACAAGCAAAATTTTACGACTAGAATTCCTACCAATAAAACAATATTTCTCCACATGATTGACCAATACCTTGT 12604
C L K M N C V R F K N A D L K D G Y F V I K R C T K S V M E H
Replicase 1b
CGAGCAATCCATGTATAACCTACTTAACTTTTCTGGTGGCTTTGGCTGAGCATGATTTCTTTACTTGGAAAGATGGCAGAGTCATTTATGGTA
GCTCGTTAGGTACATATTGGATGAATTGAAAAGACCACGAAACCGACTCGTACTAAAGAAATGAACCTTTCTACCGTCTCAGTAAATACCAT 12696
E O S M Y N L L N F S G A L A E H D F F T W K D G R V I Y G
Replicase 1b
ATGTTAGTAGACATAATCTTACTAAATATACTATGATGGACTTGGTTTATGCTATGCGTAACCTTTGATGAACAAAATGTGATGTTCTAAAA
TACAATCATCTGTATTAGAATGATTTATATGATACTACTGAACCAATACGATACGCATTGAACTACTTGTTTTAACTACTACAGATTTT 12788
N V S R H N L T K Y T M M D L V Y A M R N F D E O N C D V L K
Replicase 1b
GAAGTATTAGTTTTAACTGGTGTGTGACAATCTTATTTTGATAGTAAGGGTTGGTATGACCCAGTTGAAAATGAAGATATACATAGAGT
CTTCATAATCAAAATTGACCAACAACACTGTTAAGAATAAACTATCATTCCCAACCATACTGGGTCAACTTTTACTTCTATATGTATCTCA 12880
E V L V L T G C C O N S Y F D S K G W Y D P V E N E D I H R V
Replicase 1b
TTATGCATCTCTTGGCAAAATTTAGCTAGAGCTATGCTTAAATGCGTTGCTCTATGTGATGCGATGGTTGCTAAAGGTGTTGTTGGTGT
AATACGTAGAGAACCGTTTTAATCATGATCTCGATACGAATTTACGCAACGAGATACACTACGCTACCAACGATTTCCACAACAACCACAA 12972
Y A S L G K I V A R A M L K C V A L C D A M V A K G V V G V
Replicase 1b
TAACATTAGATAACCAAGATCTTAATGGTAACCTTTTATGATTTTGGTGATTTTGTGTTAGCTTACCTAATATGGGTGTTCCCTGTTGTACA
ATTGTAATCTATTGGTCTAGAAATTACCATGAAAATACTAAAACCACTAAACAACAATCGAATGGATTATACCCACAAGGGACAACATGT 13064
L T L D N O D L N G N F Y O F G D F V V S L P N H G V P C C T
Replicase 1b

TCATATTATTCTTATATGATGCCTATTATGGGTTTAACTAATTGTTTAGCTAGTGAGTGTTTTGTCAAGAGTGATATTJTTGGTAGTGATTT 13156
AGTATAATAAGAATATACTACGGATAATACCCAAATTGATTAAACAATCGATCACTCACAAAACAGTTCTCACTATAAAAACCATCACTAAA
S Y Y S Y M M P I M G L T N C L A S E C F V K S D I F G S D F
Replicase 1b

TAAACCTTTTGATTTGCTTAAGTATGATTTCACTGAACATAAGAAAAATTTATTCAATAAGTACTTTAAGCATTGGAGTTTTGATTATCATC 13248
ATTTTGAAAACCTAAACGAATTCATACTAAAGTGACTTGATTTCTTTAAATAAGTTATTCATGAAATTCGTAACCTCAAACTAATAGTAG
K T F D L L K Y D F T E H K E N L F N K Y F K H W S F D Y H
Replicase 1b

CTAATTGTAGTGACTGTTATGATGATATGTGTGTATACATTGTGCTAATTTAATACACTATTTGCCACAACATACCAGGTACTGCTTTT 13340
GATTAACTCACTGACAATACTACTATACACACAATATGAACAGGATTAATAATATGTGATAAACGGTGTTGATATGGTCCATGACGAAAA
P N C S D C Y D D M C V I H C A N F N T L F A T T I P G T A F
Replicase 1b

GGTCCACTATGTCGTAAAGTTTTATAGATGGTGTTCACCTGTTTACAACCTGCTGGTTATCATTTTAAGCAATTAGGTTTGGTTTGAATAA 13432
CCAGGTGATACAGCATTTCAAAAATATCTACCACAAGGTGAACAATGTTGACGACCAATAGTAAATTCGTTAATCCAAACCAACCTTATT
G P L C R K V F I D G V P L V T T A G Y H F K O L G L V W N K
Replicase 1b

AGATGTTAACACACTCAGTTAGGTTGACAATCACTGAACCTTTGCAATTTGTTACTGACCCCTTCCTTGATAATAGCTTCTCTCCAGCAC 13524
TCTACAATTGTGTGTGAGTCAATCCAACCTGTAGTGACTTGAAAACGTTAAACAATGACTGGGAAGGAACATTATCGAAGAAGAGGTCGTG
D V N T H S V R L T I T E L L O F V T D P S L I I A S S P A
Replicase 1b

TCGTTGATCAACGCACTATTTGTTTTCTGTTGAGCATTGAGTACTGGTTTGACAAATCAAGTTGTTAAGCCAGGTCATTTTAATGAAGAG 13616
AGCAACTAGTTGCGTGATAAACAAGACAAACGTCGTAACCTCATGACCAAACTGTTTGTTCACAATTCGGTCCAGTAAATTAATCTCTC
L V D O R T I C F S V A A L S T G L T N O V V K P G H F N E E
Replicase 1b

TTTTATACTTTCTTCGTTTAAGAGGTTTCTTTGATGAAGGTTCTGAACCTTACATTAACATTTCTTCTCGCACAGAATGGTGATGCTGC 13708
AAAATATTGAAAGAAGCAAAATTCCTCAAGAACTACTTCCAAGACTTGAATGTAATTTTGTAAGAAGAAGCGTGCTTACCACTACGAGC
F Y N F L R L R G F F D E G S E L T L K H F F F A O N G D A A
Replicase 1b

TGTTAAAGATTTTGACTTTTACCGTTATAATAAGCCTACCATTTTATGATATTTGTCAAGCTAGAGTTACATATAAGATAGTCTCTCGTTATT 13800
ACAATTTCTAAAACCTGAAATGGCAATATTTCGGATGGTAAATCTATAAACAGTTGATCTCAATGTATATTCTATCAGAGAGCAATAA
V K O F D F Y R Y N K P T I L O I C O A R V T Y K I V S R Y
Replicase 1b

TTGACATTTATGAAGGTGGCTGTATTAAAGCATGTGAAGTTGTTGTAACAACTTTAATAAGAGTGCTGGTTGGCCATTAATAAGTTTGGT 13892
AACTGTAAATACTTCCACCGACATAATTCCGTACACTCAACAACATTGTTTGAATTAATCTCACGACCAACCGTAATTTATTCAAACCA
F D I Y E G G C I K A C E V V V T N L N K S A G W P L N K F G
Replicase 1b

AAAGCTAGTTTGTATTACGAATCTATATCTTATGAAGAACAGGATGCTTTGTTTGCTTTGACAAAGCGTAATGTCCTCCCTACTATGACACA 13984
TTTCGATCAAACATAATGCTTAGATATAGAATACTTCTTGCTACGAAACAAACGAACTGTTTCGCATTACAGGAGGGATGATACTGTGT
K A S L Y Y E S I S Y E E Q D A L F A L T K R N V L P T M T O
Replicase 1b

GCTGAATCTTAAGTATGCTATTAGTGGTAAAGAACGTGCTAGAACTGTTGGTGGTGTCTCTGTTGTCCACAATGACCACAAGACAATACC 14076
CGACTTAGAATTCATACGATAATCACCATTCTTGCAACGATCTTGACAACCACCACAAGAGACAACAGGTGTTACTGGTGTCTGTATGG
L N L K Y A I S G K E R A R T V G G V S L L S T M T T R Q Y
Replicase 1b

ATCAAAAACATCTTAAATCCATTGTTAATACACGCAATGCCACTGTTGTTATTGGTACTACCAAATTTTATGGTGGTGGGAATAATATGTTG 14168
TAGTTTTGTAGAATTTAGGTAACAATATGTGCGTTACGGTGACAACAATAACCATGATGGTTTAAATACCACCAACCTTATTATACAAC
H O K H L K S I V N T R N A T V V I G T T K F Y G G W N N M L
Replicase 1b

CGTACTTTAATTGATGGTGTGAAAACCTATGCTCATGGGTGGGATTATCCCAAATGTGATAGAGCTTTGCCAACATGATACGTATGAT 14260
GCATGAAATTAATACCACAACCTTTGGGATACGAGTACCAACCTAATAGGGTTTACACTATCTCGAAACGGATTGTACTATGCATACTA
R T L I D G V E N P M L H G W D Y P K C D R A L P N M I R M I
Replicase 1b

TTACGCCATGGTGTGGGTTCTAAGCATGTTAATTGTTGTACTGTAACAGATAGGTTTTATAGGCTTGGTAACGAGTTGGCACAAGTTTTAA 14352
AAGTCGGTACCACAACCAAGATTGCTACAATTAACAACATGACATTGTCTATCCAAAATATCCGAACCATGCTCAACCGTGTCAAAATT
S A M V L G S K H V N C C T V T D R F Y R L G N E L A O V L
Replicase 1b

CAGAAGTGTGTTTATTCTAATGGTGGTTTTTATTTAAGCCAGGTGGTACGACTTCTGGTGACGCTAGTACAGCTTATGCTAATTTCTATTTT 14444
GTCTTCAACAAATAAGATTACCACCAAAAATAAATTTCGGTCCACCATGCTGAAGACCACTGCGATCATGTCGAATACGATTAAAGATAAAA
T E V V Y S N G G F Y F K P G G T T S G D A S T A Y A N S I F
Replicase 1b

AACATTTTCAAGCCGTGAGTTCTAACATTAACAGGTGCTTAGTGTCCCATCAGATTCATGTAATAATGTTAATGTTAGGGATCTACAACG 14536
TTGTAAGAAAGTTCGGCACTCAAGATTGTAATTGTCCAACGAATCAGGGTAGTCTAAGTACATTATTACAATTACAATCCCTAGATGTTGC
N I F O A V S S N I N R L L S V P S D S C N N V N V R D L O R
Replicase 1b

ACGCTGTATGATAATTGCTATAGGTTAACTAGTGTGAAGAGTCATTCATTGATGATTATTATGGTTATCTTAGGAAACATTTTCAATGA 14628
TGCAGACATACTATTAACGATATCCAATTGATCACAACCTCTCAGTAAGTAACCTAATAATACCAATAGAATCCTTTGTAAGAAAGTTACT
R L Y O N C Y R L T S V E E S F I D D Y Y G Y L R K H F S M
Replicase 1b

TGATTCCTCTGATGACGGTGTGCTGTTATAACAAGGATTATGCTGAGTTAGGTTATATAGCAGACATTAGTGCTTTTAAAGCCACTTTG 14720
ACTAAGAGAGACTACTGCCACAACAGACAATATTGTTCTAATACGACTCAATCCAATATATCGTCTGTAATCACGAAAATTTTCGGTGAAC
M I L S O D G V V C Y N K D Y A E L G Y I A D I S A F K A T L
Replicase 1b

TATTACCAGAATAATGCTTTATGAGTACTTCTAAATGTTGGGTTGAAGAAGATTTAACTAAGGGACCACATGAGTTTTGTTCCAGCATACT
ATAATGGTCTTATTACAGAAATACTCATGAAGATTTACAACCCAACTTCTTCTAAATTGATTCCTGGTGTACTCAAACAAGGGTCGTATG
Y Y O N N V F H S T S K C W V E E D L T K G P H E F C S O H T
Replicase 1b

TATGCAATAGTTGATAAAGATGGTACCTATTATTTGCCTTACCCAGATCCTAGTAGGATCTTGTCAGCTGGTGTGTTTGTGATGATGTTG
ATACGTTTATCAACTATTTCTACCATGGATAATAACGGAATGGGTCTAGGATCATCCTAGAACAGTCGACCACAAAACAACACTACTACAAC
H Q I V D K D G T Y Y L P Y P D P S R I L S A G V F V D D V
Replicase 1b

TTAAGACAGATGCTGTTGTTTTGTTAKAAGTTATGTGCTTTAGCTATTGATGCATACCTCTTTCAAACACCTAATTCTGAATATCGT
AATTCTGTCTACGACAAACAAATHTTGAATACACAGAAATCGAATACTAGTATGGGAGAAAGTTTGTGGGATTAAAGCTTATAGCA
V K T D A V V L L ? R Y V S L A I D A Y P L S K H P N S E Y R
Replicase 1b

AAAGTTTTTACGTATTACTTGATTGGGTTAAGCATCTTAACAAAATTTGAATGAGGGTGTCTTGAATCTTTTTCTGTTACACTTCTTGA
TTCCAAAATGTCATAATGAACATAACCAATTCGTAGAATTGTTTTAACTTACTCCACAAGAACTAGAAAAAGACATGTGAAGAACT
K V F Y V L L D W V K H L N K N L N E G V L E S F S V T L L D
Replicase 1b

TAATCAAGAAGATAAGTTTTGGTGTGAAGATTTTATGCTAGTATGTATGAAAATTTCAATATTGCAAGCTGCTGGCTTATGTGTTGTTT
ATTAGTTCTTCTATTCAAACACACTTCTAAAAATACGATCATACATCTTTTAAAGTGTATAACGTCGACGACCGAATACACAACAA
N O E D K F W C E D F Y A S H Y E N S T I L O A A G L C V V
Replicase 1b

GTGGTTCACAACTGTTCTTCGTTGGTGTGTTGCTGCGTAAGCCTATGTTGTGCACTAAATGTGCATATGATCATGTATTTGGTACCGAC
CACCAGTGTGTTGACAAGAGCAACACCCTAACAGACGATTCGGATACAAACGCTGATTTACAGCTATACTAGTACATAAACCATGGCTG
C G S O T V L R C G D C L R K P M L C T K C A Y D H V F G T D
Replicase 1b

CACAAGTTTATTTGGCTATAACACCGTATGTATGTAATGCATCAGGTTGGTGTAGTGATGTTAAAAATTGTATCTTGGTGGTTTGAA
GTGTTCAATAAAACCGATATTGTGGCATACATACATTACGTAGTCCAACACCACAATCACTACAATTTTAAACATAGAACCACCAACTT
H K F I L A I T P Y V C N A S G C G V S D V K K L Y L G G L N
Replicase 1b

TTACTATTGTACAAATCATAAACACAGTTGCTTTTCCATTATGTTCTGCTGGTAATATATTTGGTTTATAAAAATTCAGCAACTGGTT
AATGATAACATGTTTAGTATTTGGTGTCAACAGAAAAGGTAATACAAGACGACCATTATATAAACCAATATATTTTAAAGTCGTTGACCAA
Y Y C T N H K P O L S F P L C S A G N I F G L Y K N S A T G
Replicase 1b

CCTTAGATGTTGAAGTTTTAATAGGCTTGAACGCTGATTTGGACTGATGTTAGGGACTATAAACTTGCTAATGATGTTAAAGATACACTT
GGAATCTACAACCTCAAAAATTATCCGACGTTGCAGACTAACCTGACTACAATCCCTGATATTTGAACGATTACTACAATTTCTATGTGA
S L D V E V F N R L A T S D W T O V R D Y K L A N D V K D T L
Replicase 1b

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AGACTCTTTGCGGCTGAACTATTAAGCTAAAGAAGAGAGTGTAAAGTCTTCTATGCTTTTGCAACTCTTAAGAGGTTGTTGGACCTAA
TCTGAGAAACGCCGACTTTGATAATTTCGATTCTTCTCTCACAATTCAGAAGAATACGAAAACGTTGAGAATTTCTCCAACAACCTGGATT 15640
R L F A A E T I K A K E E S V K S S Y A F A T L K E V V G P K
Replicase 1b

AGAATTGCTTCTTAGTTGGGAAAGTGGTAAAGTTAAACCACCTTTGAATCGTAATTCGTTTTACCTGTTTTCAAATAAGTAAGGACTCAA
TCTTAACGAAGAATCAACCTTTACCATTTCAATTTGGTGGAACTTAGCATTAGACAAAAGTGGACAAAAGTTATTCAATCTCGAGTT 15732
E L L L S W E S G K V K P P L N R N S V F T C F Q I S K D S
Replicase 1b

AATTCCAAATAGGTGAGTTCATCTTTGAAAAGGTTGAATATGGTCTGATACTGTTACGTATAAGTCTACTGTAACTAAGTTAGTTCTCT
TTAAGGTTTATCCACTCAAGTAGAACTTTCCAACCTATACCAAGACTATGACAATGCATATTCAGATGACATTGGTGATTCAATCAAGGA 15824
K F Q I G E F I F E K V E Y G S D T V T Y K S T V T T K L V P
Replicase 1b

GGTATGATTTTGTCTTAACATCTCACAATGTTCACCTTTACGTGCACCAACTATTGCAAACCAAGAGAAGTATTCTAGCATTATATAATT
CCATACTAAAAACAGAATTGTAGAGTGTACAAGTGGAAATGCAGTGGTTGATAACGTTTGGTTCTCTTCATAAGATCGTAATATTTAA 15916
G M I F V L T S H N V O P L R A P T I A N O E K Y S S I Y K L
Replicase 1b

GCACCTGCTTTTAAATGTCAGTGATGCATATGCTAATTTGGTTCATATTACCAACTTATTGGTAAACAAAAGATAACTACAATACAGGGTC
CGTGGGACGAAAATTACAGTCACTACGTATACGATTAACCAAGGTATAATGGTTGAATAACCATTTGTTTTCTATTGATGTTATGTCCAG 16008
H P A F N V S D A Y A N L V P Y Y O L I G K O K I T T I O G
Replicase 1b

CTCTGGTAGTGGTAAGTCACATTGTTCCATTGGACTTGGATTGACTATCCAGGTGCGCGTATTGTTTTGTTGCTTGTGCCCATGCTGCT
GAGGACCATCAACATTCACTGTAACAAGGTAACTGAACCTAACATGATAGGTCCACGCGCATAACAAAACAACGAACCGGGTACGACGA 16100
P P G S G K S H C S I G L G L Y Y P G A R I V F V A C A H A A
Replicase 1b

GTTGATTCCTTATGTGCAAAAGCTATGACTGTTTATAGCATTGATAAGTGTACTAGGATTATACCTGCAAGAGCTCGGGTTGAGTGTATAG
CAACTAAGGAATACAGCTTTTCGATACTGACAAATATCGTAACATTACATGATCCTAATATGGACGTTCTCGAGCCCAACTCACAATATC 16192
V D S L C A K A M T V Y S I D K C T R I I P A R A R V E C Y S
Replicase 1b

TGGCTTTAAACCAATAACACTAGTGCACAATACATATTAGCACTGTTAACGCATTACCTGAGTGAATGCTGATATTGTTGTTGATGATG
ACCGAAATTGGTTTATTGTGATCAGTGTATGTATAAATCGTGACAATTGCGTAATGGACTCACATTACGACTATAACAACAACATCTAC 16284
G F K P N N T S A O Y I F S T V N A L P E C N A D I V V V D
Replicase 1b

AAGTTTCAATGTGTAGAAATATGACCTTTCTGTTATTAATCAGCGTTTATCATATAAACATATTGTTTATGTTGGTGATCCACAACAATT
TTCAAAGTTACACATGTTTAATCTGGAAGACAATAATTAGTCGCAATAGTATATTGTATAACAATACAACCACTAGGTGTTGTTGAA 16376
E V S M C T N Y D L S V I N O R L S Y K H I V Y V G D P O O L
Replicase 1b

CCTGCACCTAGAGTAATGATTACTAAAGGTGTTATGGAGCCTGTTGATTATAACGTTGTTACTCAACGTATGTGTGCTATAGGCCCTGATGT
GGACGTGGATCTCATTACTAATGATTTCCACAATACCTCGGACAACATAATTGCAACAATGAGTTGCATACACAGATATCCGGGACTACA 16468
P A P R V M I T K G V H E P V D Y N V V T O R M C A I G P D V
Replicase 1b

TTTTCTTCATAAATGTTATAGATGTCCTGCTGAAATAGTTAATACAGTTTCTGAACTTGTATTGAGAACAAGTTTGCCCTGTTAAACCTG
AAAAGAAGTATTACAATATCTACAGGACGACTTTATCAATTATGTCAAAGACTTGAACAAATACCTTGTTCAAACAGGACAATTGGAC 16560
F L H K C Y R C P A E I V N T V S E L V Y E N K F V P V K P
Replicase 1b

CTAGTAACAGTGTTTTAAATCTTTTTAAGGGTAATGTACAGGTGACAATGGCTCTAGTATTAAACAGAAAGCAGCTTGAAATAGTTAAG
GATCATTGTGCACAAATTTAGAAAAAATCCCAATTACATGTCCAACGTGTACCGAGATCATAATTGTCTTTCGTCGAACITTTATCAATTC 16652
A S K O C F K I F F K G N V O V O N G S S I N R K O L E I V K
Replicase 1b

CTGTTTTAGTTAAAAATCCAAGTTGGAGTAAGGCTGTGTTTATTTCTCCTTATAATAGTCAGAATTATGTTGCTAGTAGATTTTAGGACT
GACAAAAATCAATTTTAGGTTCAACCTCATTCCGACACAAATAAGAGGAATATTATCAGTCTTAATACAACGATCATCTAAAAATCCTGA 16744
L F L V K N P S W S K A V F I S P Y N S O N Y V A S R F L G L
Replicase 1b

TCAAATTCAACTGTTGATTCTTCTCAAGGTAGTGAGTATGATTATGTAATCTATGCACAACTTCTGACACTGCACATGCTTGCAATGTAA
AGTTTAAGTTTGACAACTAAGAAGAGTTCCATCACTCATACTAATACATTAGATACGTGTTTGAAGACTGTGACGTGTACGAACGTTCACAT 16836
D I D T V D S S O G S E Y D Y V I Y A O T S D T A H A C N V
Replicase 1b

ACCGTTTTAATGTTGCTATAACACGTGCTAAGAAGGTATATTTTGTTAATGTGTGATAAACTTTGTTTGATTCACTTAAGTTTTTTGAG
TGCGAAAATTACAAGATATTGTGCAGGATCTTCCCATATAAAACACATTACACACTATTTTGAACAACTAAGTGAATTCAAAAAAGCTC 16928
N R F N V A I T R A K K G I F C V M C D K T L F D S L K F F E
Replicase 1b

ATTAACATGCAGATTTACACTCTAGCCAGGTTTGTGGCTTGTAAAAAATGTACACGCACTCCTCTTAATTTACCACCAACTCATGCACA
TAATTTGTACGTCTAAATGTGAGATCGGTCCAAACACCGAACAATTTTAAACATGTGCGTGAGGAGAATTAAATGGTGGTTGAGTACGTGT 17020
I K H A D L H S S O V C G L F K N C T R T P L N L P P T H A H
Replicase 1b

CACTTTCTTGTGTTGTCAGATCAGTTTAACTACAGGTGATTAGCTGTTCAAATAGGTTCAAATAATGTTTGTACTTATGAACATGTTA
GTGAAGAACAGCAACAGTCTAGTCAAATCTGATGTCCACTAAATCGACAAGTTTATCCAAGTTTATTACAAACATGAATACTTGTACAAT 17112
T F L S L S D O F K T T G O L A V O I G S N N V C T Y E H V
Replicase 1b

TATCATTTATGGGTTTTAGGTTTGATATTAGTATTCCTGGTAGTCATAGTTTGTGTTTGTACACGTGACTTTGCTATTGTAATGTGCGTGGT
ATAGTAAATACCCAAAATCCAACTATAATCATAAGGACCATCAGTATCAACAAAACATGTGCACTGAAACGATAAGCATTACACGCACCA 17204
I S F M G F R F D I S I P G S H S L F C T R D F A I R N V R G
Replicase 1b

TGGTTGGGTATGGATGTTGAAAGTGCTCATGTTTGTGGCGATAACATAGGTACTAATGTTCTTTACAGSTTGGTTTTCAAATGGTGTTAA 17296
ACCAACCCATACCTACAACTTTCACGAGTACAACACCGCTATTGTATCCATGATTACAAGGAAATGTCCAACCAAAAAGTTACCACAATT
W L G M D V E S A H V C G D N I G T N V P L O V G F S N G V N
Replicase 1b

TTTTGTTGTGCAAACTGAAGGTTGTGTCTACCAATTTTGGTGATGTTATTAACCTGTTTGTGCAAAATCTCCACCAGGTGAACAATTA 17388
AAAACAACACGTTTGACTTCCAACACACAGATGGTTAAACCACTACAATAATTGGACAAACACGTTTAGAGGTGGTCCACTTGTAAAT
F V V Q T E G C V S T N F G D V I K P V C A K S P P G E Q F
Replicase 1b

GACACCTTGTCTCTTTTACGTAAAGGACAACCTTGGTTAATTGTTCTGACGCGATTGTGCAATGATATCTGATTATTTGTCCAATTTG 17480
CTGTGGAACAAGGAAAAATGCATTTCTGTTGGAACCAATTAACAAGCATCTGCGTAACACGTTTACTATAGACTAATAACAGGTTAAAC
R H L V P F L R K G Q P W L I V R R R I V O M I S D Y L S N L
Replicase 1b

TCTGACATTCTTGTCTTTGTTTGTGGGCAGGTAGTTTGAATTAACATAATGCGTTACTTTGTAAAAATAGGGCCAATTAATATTGTTA 17572
AGACTGAAGAACAGAAACAAACACCGTCCATCAAACCTTAATTGATGTTACGCAATGAACATTTTATCCCGGTTAATTTATAACAAT
S D I L V F V L W A G S L E L T T H R Y F V K I G P I K Y C Y
Replicase 1b

TTGTGGTAATCTGCCACTTGTATAATTCAGTTAGTAATGAATATTGTTGTTTTAAACATGCATTGGGTTGTGATTATGTTACAATCCGT 17664
AACACCATTAAAGCGGTGAACAATATTAAGTCAATCATTACTTATAACAACAAAATTTGTACGTAACCAACACTAATACAAATGTTAGGCA
C G N S A T C Y N S V S N E Y C C F K H A L G C D Y V Y N P
Replicase 1b

ATGCTTTTGATATACAACAGTGGGTTATGTTGGTTCCCTTGAGCCAGAACCACACACGTTCTGTAACATTATAGAAACGAGCATGATGCT 17756
TACGAAACTATATGTTGTACCCCAATACAACCAAGGAACCTGGTCTTGGTGGTGTGCAAGACATTGTAAGTATCTTGTCTGACTACGA
Y A F D I Q Q W G Y V G S L S O N H H T F C N I H R N E H D A
Replicase 1b

TCTGGTGATGCTGTTATGACACGTTGTTTGGCAGTACATGATTGTTTGTCAAAAATGTTGATTGGACTGTAACGTACCCCTTTATTGCAA 17848
AGACCACTACGACAATCTGTGCAACAAACCGTCATGTACTAACAAAACAGTTTTTACAATAACCTGACATTGCATGGGGAATAACGTTT
S G D A V M T R C L A V H D C F V K N V D W T V T Y P F I A N
Replicase 1b

TGAGAAATTTATCAATGGCTGTGGCGTAATGTCCAGGGACATGTTGTTGCGCGACGCTTGAAATTGTATAAACCTAGTGTATTTCATGATA 17940
ACTCTTTAAATAGTTACCGACACCCGATTACAGGTCCCTGTACAACAAGCGCTGGAACITTAACATATTGGATCACATAAGTACTAT
E K F I N G C G R N V O G H V V R A A L K L Y K P S V I H D
Replicase 1b

TTGGTAATCCTAAAGGTGACGTTGTGCTGTACTGATGCAAAATGGTACTGTTATGACAAGCAACCTGTTAATAGTAATGTCAAGTTGTTG 18032
AACCATTAGGATTCCACATGCAACAGGACAATGACTACGGTTTACCATGACAATACTGTTCTGTTGGACAATTATCATTACAGTTCAACAA
I G N P K G V R C A V T D A K W Y C Y D K O P V N S N V K L L
Replicase 1b

GATTATGATTATGCAACCCATGGTCAACTTGATGGTCTTTGTTTATTCTGGAATTGTAATGTTGATATGTATCCAGAATTTCAATTGTGTG
CTAATACTAATACGTTGGGTACCACTGGAACCTACCAGAAACAATAAGACCTTAACATTACAACATACATAGGCTCTAAAGTTAACACAC 18124

D Y D Y A T H G Q L D G L C L F W N C N V D M Y P E F S I V C
Replicase 1b

TCGCTTTGACACACGTACTCGTTCTGTTTTAATTTAGAAGGTGTTAATGGTGGTCTCTTTATGTTAACAACATGCGTTTCATACACCAG
AGCGAAACTGTGTGCATGAGCAAGACAAAAATTAATCTTCCACAATTACCACCAAGAGAAATACAATTGTTGTACGCAAAAGTATGTGGTC 18216

R F D T R T R S V F N L E G V N G G S L Y V N K H A F H T P
Replicase 1b

CATATGATAACGTGCTTTTGTAAATTAACCTATGCCCTTTTTTACTTTGATGACAGTGATTGTGATGTTGTGCAAGAACAAGTTAAT
GTATACTATTGACGAAACAATTTAATTTGGATACGGGAAAAAATGAACTACTGTCACCTAACACTACAACACGTTCTTGTTCATTA 18308

A . Y D K R A F V K L K P M P F F Y F D D S D C D V V . Q E Q V N
Replicase 1b

TATGTACCCCTCGCGCTAGTGTGTGTACCGTTGTAATATAGGTGGTGTGTTGTTCAAACATGCAAAATTTGTATCAAAAATATGT
ATACATGGGGAAGCGCATCATACACAATGGGCAACATTATATCCACCACGACAACAAGTTTGTACGTTAAACATAGTTTTATACA 18400

Y V P L R A S S C V T R C N I G G A V C S K H A N L Y O K Y V
Replicase 1b

TGAGGCATATAACATTTACACAGGCTGGTTTTAACATTTGGGTACCACATAGTTTGTATGTTTATAATTTGTGGCAAAATTTTATTGAAA
ACTCCGTATATTATGTAATGTGTCGACCAAAATGTAAACCCATGTTGTATCAAACTACAAATATTAAACACCGTTTAAAAATACTTT 18492

E A Y N T F T O A G F N I W V P H S F D V Y N L W O I F I E
Replicase 1b

CTAATTTACAAGCTTTGAAAATATAGCATTTAATGTTGTAAGGAGGTTTACTGGTGTGATGGTGAGTTACCTGTTGCAGTTGTT
GATTAATGTTTCAGAACTTTTATATCGTAAATTACAACATTTTTTCCACAAAATGACCACAACCTACCCTCAATGGACAAGCTCAACAA 18584

T N L O S L E N I A F N V V K K G C F T G V D G E L P V A V V
Replicase 1b

AACGACAAAGTTTTGTTGCTATGGCGATGTTGACAACCTGGTTTTTACAAATAAAACAACATTGCCTACTAATGTTGCTTTTGAATTGTT
TTGCTGTTTCAAAAACAAGCGATACCGCTACAACCTGTTGAACCAAAATGTTTATTTGTTGTAACGGATGATTACAACGAAAACCTAACAA 18676

N O K V F V R Y G D V D N L V F T N K T T L P T N V A F E L F
Replicase 1b

TGCAAAACGAAAAATGGGTTTAAACACCACCATGCTATTCTCAAAAATCTTGGTGTGTTGCTACATATAAATTTGTTTTATGGGATTATG
ACGTTTTGCTTTTACCCAAATTGTTGTTGTAACAGATAAGAGTTTTAGAACCACAACAACGATGTATTTAAACAAAATACCTAATAC 18768

A K R K H G L T P P L S I L K N L G V V A T Y K F V L W D Y
Replicase 1b

AAGCTGAAAGACCTTTTACCTCATATACTAAGAGTGATGTAATACACTGATTTAATGAGGATGTTGTGTTGTTTGGACAATAGTATT
TTCGACTTTCTGAAAAATGGAGTATATGATTCTCATACATTTATGTGACTAAAATTACTCTACAAACACAAACAAACTGTTATCATAA 18860

E A E R P F T S Y T K S V C K Y T D F N E D V C V C F D N S I
Replicase 1b

CAGGGTTCGTATGAGCGTTTACGCTTACTACGAACGCTGTTTTATTTTCTACTGTTGTCATTAAAAATTTAACACCTATAAGTTGAATTT
GTCCCAAGCATACTCGCAAAATGCGAATGATGCTTGGACAAAATAAAGATGACAACAGTAATTTTAAATTGGGATATTTCAACTTAAA
18952
D G S Y E R F T L T T N A V L F S T V V I K N L T P I K L N F
Replicase 1b

TGGTATGTTGAATGGTATGCCAGTTTCTTCTATTAAGAGTGATAAAGSTGTTGAAAAATTAGTTAATTGGTACACATATGTTCTGTA AAAATG
19044
ACCATACAACCTACCATACGGTCAAGAAGATAATTCCTACTATTTCCACAACCTTTTAAATCAATTAACCATGTGTATACAAGCATTTTAC
G M L N G M P V S S I K S D K G V E K L V N W Y T Y V R K N
Replicase 1b

GTCAATTTCAAGATCATTATGATGGTTTTTACACTCAAGGTAGGAATTTATCAGACTTTACACCAAGAAGTGATATGGAGTATGATTTCTT
19136
CAGTTAAAGTTCTAGTAATACTACCAAAAATGTGAGTTCCATCCTTAAATAGTCTGAAATGTGGTTCTTCACTATACCTCATACTAAAAGAA
G O F O D H Y D G F Y T O G R N L S D F T P R S D M E Y D F L
Replicase 1b

AACATGGATATGGGTGTTTTTATTAATAATATGGTCTTGAGGATTTTAAATTTGAACATGTTGTATATGGTATGTTTCAAAAACCTACATT
19228
TTGTACCTATACCCACAAAATAATTATTTATACCAGAATCCTTAAATTTAAACCTGTACAACATATACCACTACAAGTTTTTGTATGTA
N M D M G V F I N K Y G L E D F N F E H V V Y G D V S K T T L
Replicase 1b

AGGAGGTCTTCATTTGTTGATATCAGTCTTAGGCTTAGTAAATGGGTGTTTTGAAAGCTGATGATTTTGTCACTGCTTCTGACACAACCTT
19320
TCCTCCGAAGTAAACAACATATAGTGCAATCCGAATCATTTTACCCACAAAACCTTTCGACTACTAAAACAGTGACGAAGACTGTGTGAA
G G L H L L I S O F R L S K M G V L K A D D F V T A S D T T
Replicase 1b

TGAGGTGCTGACTGTTACTTATCTTAATGAACCTAGTTCAAAAGTTGTTGTACTTATATGGATTTGTTGTTGGACGACTTTGTTACTATA
19412
ACTCCACGACATGACAATGAATAGAACTTGAATCAAGTTTTCAACAAACATGAATATACCTAAACAACAACCTGCTGAAACAATGATAT
L R C C T V T Y L N E L S S K V V C T Y M D L L L D D F V T I
Replicase 1b

CTAAAGAGTTTAGATCTTGGTGTAATATCTAAAGTTCATGAAGTTATTATAGATAATAAACCTTATAGGTGGATGTTGTTGGTGTAAGATAA
19504
GATTTCTCAAATCTAGAACCACTTATAGATTCAAGTACTTCAATAATATCTATTATTGGAATATCCACCTACAACACCACATTTCTATT
L K S L O L G V I S K V H E V I I D N K P Y R W M L W C K D N
Replicase 1b

CCACTTGTGACTTTTTATCCACAGTTGCAGTCTGCTGAATGGAAGTGGTTATGCTATGCCACAAATTTATAAGCTTCAACGTATGTGTT
19596
GGTGAACAGCTGAAAAATAGGTGTCAACGTCAGACGACTTACCTTCACACCAATACGATACGGTGTAAATATTCGAAGTTGCATACACAA
H L S T F Y P O L O S A E W K C G Y A M P O I Y K L O R M C
Replicase 1b

TGGAACCTTGTAATTTATATAATTATGGTCTGGTATTAAGTTGCCTAGTGGTATAATGTTAAATGTTGTTAAATACACTCAGCTTTGTCAA
19688
ACCTTGAACATTAAATATATTAATACCACGACCATAATTCAACGGATCACCATTACAATTTACAACAATTTATGTGAGTCGAACAGTT
L E P C N L Y N Y G A G I K L P S G I M L N V V K Y T O L C O
Replicase 1b

TACCTAAATAGCACTACAATGTGCGTACCTCATAATATGCGTGTTTTGCACTATGGTGCTGGTTCTGACAAAGGTGGCACCTGGTACAAC
ATGGATTTATCGTGATGTTACACGCATGGAGTATTATACGCACAAAACGTGATACCACGACCAAGACTGTTCCACACCGTGGACCATGTTG 19780

Y L N S T T H C V P H N M R V L H Y G A G S D K G V A P G T T
Replicase 1b

TGTTTTAAACGTTGGCTACCACCTGATGCAATAATCATTGATAATGATATCAATGATTATGTTAGTGATGCAGATTTTAGCATTACAGGTG
ACAAAATTTTGCAACCGATGGTGGACTACGTTATTAGTAACCTATTACTATAGTTACTAATAACAATCACTACGTCTAAAATCGTAATGTCCAC 19872

V L K R W L P P D A I I I D N D I N D Y V S D A D F S I T G
Replicase 1b

ATTGTGCTACTGTTTACCTTGAAGATAAGTTTGACTTACTTATTTCTGATATGATGATGGTAGAATTAATTTTGATGGTGAACCGTC
TAACACGATGACAAATGGAACCTCTATTCAAACCTGAATGAATAAGACTATACATACTACCATCTTAATTTAAACACTACCACTTTTGACG 19964

D C A T V Y L E D K F D L L I S D M Y D G R I K F C D G E N V
Replicase 1b

TCTAAAGATGGTTTTTACTTATCTTAATGGTGTATTAGAGAAAAATTAGCTATTGGTGGTAGTGTGCCATTAAGATTACAGAATATAG
AGATTTCTACCAAAAAATGAATAGAATTACCACAATAATCTCTTTTAAATCGATAACCACCATCACAACGGTAATTCTAATGTCTTATATC 20056

S K O G F F T Y L N G V I R E K L A I G G S V A I K I T E Y S
Replicase 1b

TTGGAATAAGTATCTTTATGAATTAATACAAAGATTTGCTTTTGGACTTTGTTCTGCACGCTGTGTAATACATCCTCTTCAGAAGCTTTTC
AACCTTATTCATAGAAATCTTAATTATGTTTCTAAACGAAAAACCTGAAACAAGACGTGCAGACAATTATGTAGGAGAAGCTTTCGAAAAAG 20148

W N K Y L Y E L I O R F A F W T L F C T S V N T S S S E A F
Replicase 1b

TTATTGGTATTAATTATTTAGGTGACTTTATTCAAGGTCCTTTTATAGCTGGTAACACTGTTTCATGCTAATTATATTTTGGCGTAATTCT
AATAACCATAATTAATAATCCACTGAAATAAGTTCCAGGAAATATCGACCATTGTGACAAGTACGATTAATATATAAAACCGCATTAAGA 20240

L I G I N Y L G D F I O G P F I A G N T V H A N Y I F W R N S
Replicase 1b

ACTATTATGCTTTGTCATACAATTCAGTTTATAGATTAAGTAAGTTTGAATGTAACATAAGGCCACTGTTGTTGTACACTTAAAGATAG
TGATAATACAGAAACAGTATGTTAAGTCAAAATCTAAATTCATTCAAACCTTACATTGTTATTCCGGTGACAACAACAATGTGAATTTCTATC 20332

T I M S L S Y N S V L D L S K F E C K H K A T V V V T L K D S
Replicase 1b

TGATGTAATGATATGGTTTTGAGTTTGATTAAGAGTGGTAGGTTGTTGTTACGTAATAGTGGCCGTTTTGGTGGTTTTAGTAATCATTTAG
ACTACATTTACTATACCAAACTCAAACCTAATCTCACCATCCAACAACATGCATTATCACCAGCAAAACCAACCAATCATTAGTAATC 20424

D V N D M V L S L I K S G R L L L R N S G R F G G F S N H L
Replicase 1b

TCTCAACTAAATGAAACTTTTCTTGATTTTGCTTATTTTGCCCTGGTTTCTGCTTTTCTACATGTAACAGTAATGCTAGTATTTCTATGT
AGAGTTGATTTACTTTGAAAAGAACTAAACGAATAAACGGGGACCAAGAACGAAAGATGTACATTGTCATTACGATCATAAGATACA 20516

M K L F L I L L I L P L V S C F S T C N S N A S I S M
Spike

V S T K
Replicase 1b

TACAATTAGGTGTTCTGATAACTCTTCAACTATTGTCACAGGTTTGTGCCAGTCCATTGGATTTGTGCTAATCAGAGTACATCTAGTTAC
ATGTTAATCCACAAGGACTATTGAGAAGTTGATAACAGTGTCCAACACGGTCAGGTAACCTAACACGATTAGTCTCATGTAGATCAATG 20608

L Q L G V P D N S S T I V T G L L P V H W I C A N O S T S S Y
Spike

CCAGCCAACGGCTTTTCTATATTGATGTTGGTAAACACCGTAGTGCCCTTTCAGTCCATAGTGGTTATTATGATGCTAACAGTATTATAT
GGTCGGTTGCCGAAAAGATATAACTACAACCATTTGTGGCATCAGGAAACGTGAGGTATCACCATAATACTACGATTGGTCATAATATA 20700

P A N G F F Y I D V G K H R S A F A L H S G Y Y D A N Q Y Y I
Spike

TTATCTCACTAATAAAATACATTTAAATGCTCCTGTCACTCTGAAGATTGTAAGTTTGGAAACACTTCTTTTGATTTTTTAAGTAATGTTT
AATAGAGTGATTATTTATGTAAATTTACGAGGACAGTGAGACTTCTAACATTCAAACCTTTGTGAAGAAACTAAAAATTCATTACAAA 20792

Y L T N K I H L N A P V T L K I C K F G N T S F D F L S N V
Spike

CTACTTCTCATGATTGTATAGTTAATTTGTCATTCACAGAAGTAGGTGTGCCCTTTGGGCATAACTATATCGGGTGAAACTGTACGTTTG
GATGAAGAGTACTAACATATCAATTAACAGTAAGTGTCTTGTCAATCCACAGGAAACCGTATTGATATAGCCCACTTTGACATGCAAAC 20884

S T S H D C I V N L S F T E O L G V P L G I T I S G E T V R L
Spike

CATTTATATAATGCAACTCGTACTTTTATGTGCCGGCCGCTTATAAACTTACTAAACTTAGTGTTAAATGTTACTTTAGTGAATCCTGTGT
GTAATATATTACGTTGAGCATGAAAAATACAGGCCGGCGAATATTTGAATGATTTGAATCACAATTTACAATGAAATCACTTAGGACACA 20976

H L Y N A T R T F Y V P A A Y K L T K L S V K C Y F S E S C V
Spike

TTTAGTGTTGCAATGCCACCATTACTGTTAATGTCACCACACTTAATGGCCGTATAGTTAACTACACGTGTTGTGATGATTGTAATGGTT
AAAATCACAACAGTTACGGTGGTAATGACAATTACAGTGGTGAATTACCGGCATATCAATTGATGTGACAAACACTACTAACATTACCAA 21088

F S V V N A T I T V N V T T L N G R I V N Y T V C D D C N G
Spike

ATACTGATAACATATTTCTGTTCAACAGGATGGCCGATTCTAATGGTTTCCCTTTTAATAATTGGTTTTGTTAACTAATGGTCCACA
TATGACTATTGTATAAAGACAAGTTGTCTACCGGGTAAGGATTACCAAGGAAAAATTATAACCAAAAACAAATTGATTACCAAGGTGT 21160

Y T D N I F S V O O D G R I P N G F P F N N W F L L T N G S T
Spike

TTAGTGGACGGGGTCTCTAGACTTTATCAACCACTCCGTTTAACTTGTTTATGGCCTGTACCTGGTCTTAAATCTTCAACTGGTTTTGTTTA
AATCACTGCCCCAGAGATCTGAAATAGTTGGTGAGGCAAATTGAACAAATACCGGACATGGACCAGAATTTAGAAGTTGACCAAAACAAAT 21252

L V D G V S R L Y O P L R L T C L W P V P G L K S S T G F V Y
Spike

TTTTAATGCCACTGGTCTGATGTTAATTGTAACGGCTATCAACATAATTCTGTTGCTGATGTTATGCGTTACAATCTTAACCTCAGTGCTA
AAAATTACGGTGACCAAGACTACAATTAACATTGCCGATAGTTGTTAAGACAACGACTACAATACGCAATGTTAGAATTGGAGTCACGAT 21344

F N A T G S D V N C N G Y Q H N S V A D V M R Y N L N L S A
Spike

ATTCTGTGGACAATCTTAAGAGTGGTGTATAGTTTTTAAACTTTACAGTACGATGTTTGTGTTTATGTTAGTAATCTTCTTCAGGTGTT
TAAGACACCTGTTAGAATTCTCACCACAATATCAAAAATTTGAAATGTCATGCTACAAAACAAAATAACATCATTAGAAGAAGTCCACAA 21436

N S V D N L K S G V I V F K T L O Y D V L F Y C S N S S S G V
Spike

CTTGACACCACAATACCTTTTGGCCCTTCTCTCAACCTTATTACTGTTTATAAACAGTACTATCAACACTACTCATGTTAGCACTTTTGT
GAACTGTGGTGTATGGAACCGGGAAGGAGAGTTGGAATAATGACAAAATATTGTCATGATAGTTGTGATGAGTACAATCGTGAAACAA 21528

L D T T I P F G P S S O P Y Y C F I N S T I N T T H V S T F V
Spike

GGGTATTTTACCACCACTGTGCGTGAAATTGTTGTTGCTAGAAGTGGTCAGTTTTATATTAATGGTTTTAAGTATTTGATTGGGTTTCA
CCCATAAAATGGTGGTGACACGCACCTTAAACAACGATCTTGACCAGTCAAAATATAATTACCAAAATTCATAAAGCTAAACCCAAAGT 21620

G I L P P T V R E I V V A R T G O F Y I N G F K Y F D L G F
Spike

TAGAAGCTGTCAATTTAATGTCAAGACTGCTAGTGCCACAGATTTTGGACGGTTGCATTTGCTACTTTTGTGATGTTTGGTTAATGTT
ATCTTCGACAGTTAAAATTACAGTGCTGACGATCACGGTGTCTAAAACCTGCCAACGTAACGATGAAAACAACTACAAAACCAATTACAA 21712

I E A V N F N V T T A S A T D F W T V A F A T F V D V L V N V
Spike

AGTGCACTAACATTCAAACTTACTTTATTGCGATTCTCCATTTGAAAAGTTGCAGTGTGAGCACTTGCAGTTTGGATTGCAAGATGGTTT
TCACGTTGATTGTAAGTTTGAATGAAATAACGCTAAGAGGTAACTTTTCAACGTCACACTCGTGAACGTCAAACCTAACGTTCTACCAAA 21804

S A T N I O N L L Y C D S P F E K L O C E H L O F G L O D G F
Spike

TTATTCTGCAAATTTCTTGATGATAATGTTTGCCTGAGACTTATGTTGCACTCCCATTTATTATCAACATACGGACATAAATTTACTG
AATAAGACGTTTAAAGAAGTACTATTACAAAACGGACTCTGAATACAACGTGAGGGGTAATAAGTTGTATGCTGTATTTAAATGAC 21896

Y S A N F L D D N V L P E T Y V A L P I Y Y O H T D I N F T
Spike

CAACTGCATCTTTTGGTGGTCTGTTGTTGTTGTAACACGCCAGGTTAATATATCTTAAATGGTAACACTTCAGTGTGTTAGAACA
GTTGACGTAGAAAACCAACAAGAACAATACAAACATTTGGTGGGTCGAATTATATAGAGAATTACCATTTGTGAAGTCACACACAATCTTGT 21988

A T A S F G G S C Y V C K P R O V N I S L N G N T S V C V R T
Spike

TCTCATTTTCAATTAGGTATATTATAACCGCTTAAGAGTGGTTCACCAAGTGACTCTTCATGGCATATTTATTTAAAGAGTGGCACTTG
AGAGTAAAAAGTTAATCCATATAAATATTGGCGCAATTCACCAAGTGGTCCACTGAGAAGTACCGTATAAATAAATTTCTCACCGTGAAC 22080
S H F S I R Y I Y N R V K S G S P G D S S W H I Y L K S G T C
Spike

TCCATTTTCTTTTCTAAGTTAAATAATTTCAAAGTTTAAGACTATTTGTTTCTCAACCGTCAAGTGCCTGGTAGTTGTAATTTCCAC
AGGTAAAGAAAAAGATTCAATTTATTAAGTTTCAAATTCGTATAAACAAGAGTTGGCAGCTTCACGGACCATCAACATTAAGGTG 22172
P F S F S K L N N F O K F K T I C F S T V E V P G S C N F P
Spike

TTGAAGCCACCTGGCATTACACTTCTTATACTATTGTTGGTGCTTTGTATGTTACTTGGTCTGAAGTAATTCATTACTGGTGACCTTAT
AACTCGGTGGACCGTAATGTGAAGAATATGATAACAACACGAAACATACAATGAACCAGACTTCCATTAAGGTAATGACCACATGGAATA 22264
L E A T W H Y T S Y T I V G A L Y V T W S E G N S I T G V P Y
Spike

CCTGCTCTGGTATTCGTGAGTTTAGTAATTTAGTTTAAATAATTGTACCAATATAATATTTATGATTATGTTGGTACTGGAATTATACG
GGACAGAGACCATAGCACTCAAAATCAATTAATCAAATTTATTAACATGGTTTATATTATAAATACTAATACAACCATGACCTTAATATGC 22356
P V S G I R E F S N L V L N N C T K Y N I Y D Y V G T G I I R
Spike

TTCTCAAACCAAGTCACTTGTGGTGGTATTACATATGTTTCTAAGTCTGGTAATTTACTTGGTTTAAAAATGTTTCCACTGGTAACATTT
AAGAAGTTTGGTCACTGAACGACCACCATATGTATACAAGATTGAGACCATTAATGAACCAAAATTTTACAAGGTGACCATTGTAATA 22448
S S N O S L A G G I T Y V S N S G N L L G F K N V S T G N I
Spike

TTATTGTGACACCATGTAACCAACAGATCAAGTAGCTGTTTATCAACAAAGCATTATTGGTGCCATGACCGCTGTTAATGAGTCTAGATAT
AATAACACTGTGGTACATTGGTGGTCTAGTTCATCGACAAATAGTTGTTTCTGTAATAACCAAGTACTGGCGACAATTACTCAGATCTATA 22540
F I V T P C N O P D O V A V Y O O S I I G A M T A V N E S R Y
Spike

GGCTTGCAAACTTACTACAGTTACCTAACTTTTATTATGTTAGTAATGGTGGTAACAATTGCACTACGGCTGTTATGATTTATTCTAATTT
CCGAACGTTTTGAATGATGTCAATGGATTGAAATAATACAATCAATTACCACCATGTTAACGTGATGCCGACAATACTAAATAAGATTAAA 22632
G L O N L L O L P N F Y Y V S N G G N N C T T A V M I Y S N F
Spike

TGGTATTTGTGCTGATGGTCTTTAATTCCTGTTTCGTCGCGTAATTTCTAGTGATAATGGTATTTTACGCCATAATCACTGCTAATTTATCCA
ACCATAAACAGCACTACCAAGAAATTAAGGACAAGCAGCGCATTAAAGTCACTATTACCATAAAGTCGGTATTAGTGACGATTAATAGGT 22724
G I C A D G S L I P V R P R N S S D N G I S A I I T A N L S
Spike

TTCCCTCTAACTGGACTACTTCAGTTCAAGTTGAGTACCTCCAAATTAAGTACTCCAATAGTTGTTGATTGTGCTACTTATGTGTGTAAT
AAGGGAGATTGACCTGATGAAGTCAAGTTCAACTCATGGAGGTTAATGATCATGAGGTTATCAACAACAACTAACACGATGAATACACATTA 22816
I P S N W T T S V O V E Y L O I T S T P I V V D C A T Y V C N
Spike

GGTAACCCCTCGTTGTAAGAATCTACTTAAGCAGTATACTTCTGCTTGAAAACTATTGAAGATGCCCTACGACTTAGTGCTCATTTGGAAAC
CCATTGGGAGCAACATTCTTAGATGAATTCGTCATATGAAGACGAACATTTTGATAACTTCTACGGAATGCTGAATCACGAGTAAACCTTGG 22908

G N P R C K N L L K O Y T S A C K T I E D A L R L S A H L E T
Spike

TAATGATGTTAGTAGTATGCTAACTTCGATAGCAATGCTTTTAGTTGGCTAATGTTACTAGTTTTGGAGATTATAACCTTTCTAGTGT
ATTACTACAATCATCATACGATTGAAAGCTATCGTTACGAAATCAAACCGATTACAATGATCAAACCTCTAATATTGGAAGATCACAAA 23000

N D V S S H L T F D S N A F S L A N V T S F G D Y N L S S V
Spike

TACCTCAGAGAAACATTCATTCAAGCCGTATAGCAGGACGTAGTGCTTTGGAAGATTGTTGTTTAGCAAAGTTGTACATCTGGTTTGGGT
ATGGAGTCTCTTTGTAAGTAAGTTCGGCATATCGTCTGCATCAGGAACCTTCTAACAACAAATCGTTTCAACAATGTAGACCAAAACCA 23092

L P O R N I H S S R I A G R S A L E D L L F S K V V T S G L G
Spike

ACTGTTGATGTTGACTATAAGTCTTGACTAAAGGTCTTTCTATTGCTGACCTTGCTTGTGCTCAGTACTACAATGGCATAATGGTTTGGC
TGACAACTACAATGATATTCAGAACATGATTTCAGAAAGATAACGACTGGAACGAACACGAGTCATGATGTTACCGTATTACCAAAACGG 23184

T V D V D Y K S C T K G L S I A D L A C A O Y Y N G I M V L P
Spike

AGGTGTTGCTGATGCTGAACGTATGGCCATGTACACAGGTTCTTATAGTGGCATGGTCTCGGAGGTCTTACATCAGCAGCGCCATAC
TCCACAACGACTACGACTTGCATACCGGTACATGTGTCCAGAGAATATCCACCGTACCACGAGCCTCCAGAATGTAGTCGTGGCGGTATG 23276

G V A D A E R H A M Y T G S L I G G M V L G G L T S A A A I
Spike

CTTTTCTTTGGCACTGCAAGCAGCTTAACATATGTTGCTTTACAACTGATGTGCTTCAAGAAAATCAGAAAATTTTGGCTGCATCATTT
GAAAAGAAACCGTGACGTTCGTGCTGAATTGATACAACGAATGTTTGACTACACGAAGTTCTTTTAGTCTTTTAAACCGAGCTAGTAA 23368

P F S L A L O A R L N Y V A L O T D V L O E N O K I L A A S F
Spike

AATAAGGCTATTAATAATATTGTTGCTTTCTTTTAGTAGCGTTAATGATGCTATTACACATACTGCAGAGGCTATACATACTGTTACTATTGC
TTATCCGATAATTATTATAACAACGAAGAAAATCATCGCAATTACTACGATAATGTGTATGACGCTCCGATATGTATGACAATGATAACG 23460

N K A I N N I V A S F S S V N D A I T H T A E A I H T V T I A
Spike

ACTTAATAAGATTCAGGATGTTGTTAATCAACAGGGTAGTGCTTTAACCATCTCACTTCACAATTGAGACATAATTTTCAGGCCATTCTA
TGAATTATTCTAAGTCTACAACAATTAGTTGTCCCATCAGGAAATTGGTAGAGTGAAGTGTTAACTCTGTATTAAAGTCCGGTAAAGAT 23552

L N K I O D V V N O O G S A L N H L T S O L R H N F O A I S
Spike

ATTCAATTGATGCTATTTATGACCGGCTTGATTCAATTCAAGCCGATCAACAAGTTGACAGATTAACTGGACGGCTTGACGCTTTGAAT
TAAGTTAAGTACGATAAATCTGGCCGAACTAAGTTAAGTTGGGCTAGTTGTTCAACTGCTAATTAATGACCTGCCGAACGTGAAACCTTA 23644

N S I H A I Y D R L O S I O A O O Q V O R L I T G R L A A L N
Spike

GCATTGTTTCCCAAGTTTGAATAAATATACTGAAGTTCGTTCCAGACGCTTAGCACAGCAGAAGATTAAATGAATGTGCAAGTCACA
CGTAAACAAAGGGTTCAAACTTATTTATATGACTTCAAGCACCAAGGTCTGCGAATCGTGTCTTCTAATTACTTACACAGTTCAGTGT 23736

A F V S Q V L N K Y T E V R G S R R L A Q Q K I N E C V K S Q
Spike

ATCTAATAGATATGGTTTTGTGGCAATGGCACTCACATCTTTCAATCGTCAACTCAGCTCCAGATGGTTTGTCTTTCTTCATACTGTTT
TAGATTATCTATACCAAAACACCGTTACCGTGAGTGTAGAAAAGTTAGCAGTTGAGTCGAGGTCTACCAACGAAAAAGAAGTATGACAAA 23828

S N R Y G F C G N G T H I F S I V N S A P D G L L F L H T V
Spike

TGCTGCCAACTGATTACAAGAATGTAAAGCGTGGTCTGGTATCTGTGTGATGGCATTATGGCTATGTTCTGCGTCAACCTAACTTGGTT
ACGAGGGTTGACTAATGTCTTACATTTCCGACACCAGACCATAGACACAACCTACCGTAAATACCGATACAAGACGAGTTGGATTGAACCAA 23920

L L P T D Y K N V K A W S G I C V D G I Y G Y V L R O P N L V
Spike

CYTTATCTGATAATGGTGTCTTTCGTGTAACITCCAGGGTCATGTTTCAACCTCGTTTACCTGTTTTGCTGATTTTGTGCAAAATATATA
GAAATAAGACTAT, TACCACAGAAAGCACATTGAAGGTCCAGTACAAAGTTGGAGCAAATGGACAAAACAGACTAAAACACGTTTATATATT 24012

L Y S D N G V F R V T S R V M F O P R L P V L S D F V O I Y N
Spike

TTGTAATGTTACTTTTGTTAATATCTCGTGTGAGTTACATACTGTCATACCTGACTACGTTGATGTTAATAAAACATTACAAGAGTTTG
AACATTACAATGAAAACAATTGTATAGAGCACAGCTCAATGTATGACAGTATGGACTGATGCAACTACAATTATTTTGTAAATGTTCTCAAAC 24104

C N V T F V N I S R V E L H T V I P D Y V O V N K T L O E F
Spike

CACAAAACCTACCAAAGTATGTTAAGCCTAATTTGACTTGACTCCTTTTAATTTAACATATCTTAATTTGAGTTCTGAGTTGAAGCAACTC
GTGTTTGAATGGTTTCATACAATTGCGATTAAACTGAACTGAGGAAAATTAATTTGTATAGAATTAACCTCAAGACTCAACTTCGTTGAG 24196

A D N L P K Y V K P N F D L T P F N L T Y L N L S S E L K O L
Spike

GAACTAAAACCTGCTAGTCTTTTCCAACTACTGTTGAATTACAAGGTCTTATTGATCAGATTAACTAGTACATATGTTGATTGAAGTTGCT
CTTCGATTTTGACGATCAGAAAAGGTTTGATGACAACTTAATGTTCCGAATAACTAGTCTAATGTCATGTATACAACCTAACTTCAACGA 24288

E A K T A S L F O T T V E L O G L I D O I N S T Y V D L K L L
Spike

TAATAGGTTTGAAAATTATATCAAAATGGCCTTGGTGGGTTTGGCTCATTATTTCTGTTGTTTTGTTGATTGTTGAGTCTTCTTGTTGTTT
ATTATCCAACTTTTAAATATAGTTTACCGGAACCAACCAACCGAGTAATAAGACACAACAAAACAACATAACAACCTCAGAAGAACAACAAA 24380

N R F E N Y I K W P W W V W L I I S V V F V V L L S L L V F
Spike

GTTGCTTTCTACAGGTTGTTGTTGTTGTTGCAATTGTTTAACTTCATCAATGCGAGGCTGTTGTGATTGTGTTCAACTAACTTCCTTAT
CAACAGAAAGATGTCCAACACCAACCAACGTTAACAATGAAGTAGTTACGCTCCGACAACACTAACCAAGTTGATTGAAGGAATA 24472

C C L S T G C C G C C N C L T S S H R G C C D C G S T K L P Y
Spike

TATGAATTTGAAAAGGTCCAGTTCATAATGCCTTTCGGTGGCCTATTTCAACTTACTCTTGAAAGTACTATTAATAAGAGTGTGGCTAAT
ATACTTAACTTTTCCAGGTGCAAGTTATTACGGAAGCCACCGGATAAAGTTGAATGAGAACTTTCATGATAATTATTCTCACACCGGATTA 24564
Y E F E K V H V Q
Spike
M P F G G L F Q L T L E S T I N K S V A N
ORF 4ab

CTCAAATTACCACCTCATGATGTTACTGTCTTGGGTGACAATCTTAAACCTGTTACTACACTTAGTACTATCACTGCTTATTTGTTAGTTAG 24656
GAGTTTAATGGTGGAGTACTACAATGACAGAAGCACTGTTAGAATTTGGACAATGATGTGAATCATGATAGTGACGAATAAACAATCAATC
L K L P P H D V T V L R D N L K P V T T L S T I T A Y L L V S
ORF 4ab

TTTGGTTGCACTTATTTTGTCTTATTCAAACCTCTTACTGCTAGAGGTGCGGTGCTTGTCTTTGTTTAAACTATTGACACTATCTGTCT 24748
AAACAAACAGTGAATAAAACGAAATAAGTTTGAGAATGACGATCTCCAGCGCAACGAACAAACAAAATTTTGATAACTGTGATAGACAGA
L F V T Y F A L F K P L T A R G R V A C F V L K L L T L S V
ORF 4ab

ATGTGCCTTTATTGGTTCTTTTGGTATGTATCTTGACAGTTTTATAATTTTTTCTACGCTGTTGTTTCGATTCATACATGTTGGCTATT 24840
TACACGGAATAAACCAGAAACCATACATAGAACTGTCAAAATATTAAGATGCGACAACAAAGCTAAGTATGTACAACCGATAA
Y V P L L V L F G M Y L D S F I I F F L R C C F D S Y M L A I
ORF 4ab

ATGCCTATCTCTAATAAAAAATTTTCATTTGTTTGTTCATGTTACTAACTATGCTTCGTTTCAGGCAAGTGTGGTATCTTGAACAATC 24932
TACGGATAGAGATTATTTTAAAGTAACAAACAAGTTACAATGATTGATACGAAGCAAGTCCGTTTACAACCATAGAACTTGTAG
M P I S N K N F S F V L F N V T K L C F V S G K C W Y L E O S
ORF 4ab

ATTTTATGAAATCGTTTGTCTGCTATTTATGGTGGTGACCACTATGTCGTTTGGTGGTGAACTATTACTTTTGTCTTTTGTATGACC 25024
TAAATACCTTTTAGCAAAACGACGATAAATACCACCACTGGTGATACAGCAAAATCCACCCTTTGATAATGAAACAAAGAACTACTGG
F Y E N R F A A I Y G G D H Y V V L G G E T I T F V S F D D
ORF 4ab

TTTATGTTGCTATTAGAGGTTCTTGTGAAAGAACCTACAACCTATGCGTAAGGTTGACTTGTATAATGGTGTGCTCATTTACATTTTGGC 25116
AAATACAACGATAATCTCCAAGAACACTTTTCTGGATGTTGAATACGATTCCAACCTGAACATATTACCACGACAGTAAATGTAACAAACGG
L Y V A I R G S C E K N L O L M R K V D L Y N G A V I Y I F A
ORF 4ab

GAAGAGCCTGTTGTTGGTATAGTTTACTCCTCTCAACTATACGAAGATGTTCTTCGATTAAATTGATGACAATGGCATTGTCCTCAATTCTA 25208
CTTCTCGGACAACAACCATATCAAATGAGGAGAGTTGATATGCTTCTACAAGGAAGCTAATTAACCTACTGTTACCGTAACAGGAGTTAAGT
M F L R L I D D N G I V L N S
E E P V V G I V Y S S O L Y E D V P S I N
ORF 4ab

Fig. 3f: Matrix amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV	SARS
EMCR	1.000	0.615	0.650	0.441	0.429	0.400	0.437	0.317	0.317	0.317	0.303	0.303	0.239	0.286
229E	---	1.000	0.557	0.380	0.372	0.344	0.384	0.317	0.309	0.309	0.299	0.316	0.269	0.277
PEDV	---	---	1.000	0.460	0.452	0.386	0.460	0.351	0.360	0.364	0.358	0.363	0.234	0.303
TGEV	---	---	---	1.000	0.878	0.758	0.958	0.330	0.334	0.346	0.335	0.332	0.208	0.254
CaCoV	---	---	---	---	1.000	0.757	0.878	0.311	0.315	0.326	0.319	0.304	0.192	0.243
FeCoV	---	---	---	---	---	1.000	0.772	0.268	0.279	0.286	0.272	0.265	0.174	0.234
PRCoV	---	---	---	---	---	---	1.000	0.330	0.334	0.346	0.335	0.332	0.215	0.262
OC43	---	---	---	---	---	---	---	1.000	0.934	0.947	0.848	0.818	0.270	0.386
PHEV	---	---	---	---	---	---	---	---	1.000	0.943	0.870	0.839	0.278	0.391
BoCoV	---	---	---	---	---	---	---	---	---	1.000	0.870	0.938	0.271	0.382
MHV	---	---	---	---	---	---	---	---	---	---	1.000	1.000	0.275	0.369
RatSA	---	---	---	---	---	---	---	---	---	---	---	1.000	0.262	0.369
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.262
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3g: Nucleoprotein amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	OC43	PHEV	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.363	0.331	0.319	0.329	0.339	0.188	0.183	0.179	0.183	0.214	0.179
229E	---	1.000	0.345	0.333	0.304	0.326	0.330	0.194	0.192	0.192	0.192	0.203	0.181
PEDV	---	---	1.000	0.279	0.248	0.275	0.275	0.165	0.164	0.164	0.162	0.182	0.180
TGEV	---	---	---	1.000	0.761	0.963	0.897	0.220	0.203	0.205	0.203	0.234	0.196
FeCoV	---	---	---	---	1.000	0.756	0.763	0.212	0.192	0.195	0.197	0.217	0.185
PRCoV	---	---	---	---	---	1.000	0.879	0.220	0.205	0.207	0.205	0.231	0.192
CaCoV	---	---	---	---	---	---	1.000	0.216	0.220	0.199	0.199	0.217	0.199
RSDAC	---	---	---	---	---	---	---	1.000	0.693	0.697	0.697	0.293	0.208
MHV	---	---	---	---	---	---	---	---	0.684	0.684	0.682	0.290	0.216
PHEV	---	---	---	---	---	---	---	---	1.000	0.948	0.953	0.270	0.199
OC43	---	---	---	---	---	---	---	---	---	1.000	0.973	0.272	0.203
BoCoV	---	---	---	---	---	---	---	---	---	---	1.000	0.274	0.203
SARS	---	---	---	---	---	---	---	---	---	---	---	1.000	0.206
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3h: Matrix nucleotide identity

Seq->	SARS	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV
SARS	1.000	0.286	0.281	0.303	0.254	0.243	0.258	0.262	0.386	0.400	0.391	0.382	0.369	0.262
EMCR	---	1.000	0.615	0.650	0.441	0.429	0.441	0.437	0.317	0.317	0.317	0.303	0.303	0.239
229E	---	---	1.000	0.557	0.380	0.365	0.376	0.380	0.321	0.313	0.313	0.303	0.320	0.269
PEDV	---	---	---	1.000	0.460	0.452	0.425	0.460	0.351	0.360	0.364	0.358	0.363	0.234
TGEV	---	---	---	---	1.000	0.878	0.836	0.958	0.330	0.334	0.346	0.335	0.332	0.208
CaCoV	---	---	---	---	---	1.000	0.835	0.878	0.311	0.315	0.326	0.319	0.304	0.192
FeCoV	---	---	---	---	---	---	1.000	0.851	0.296	0.307	0.315	0.300	0.292	0.192
PRCoV	---	---	---	---	---	---	---	1.000	0.330	0.334	0.346	0.335	0.332	0.215
OC43	---	---	---	---	---	---	---	---	1.000	0.934	0.947	0.848	0.818	0.270
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.943	0.848	0.818	0.270
BoCoV	---	---	---	---	---	---	---	---	---	---	1.000	0.870	0.839	0.278
MHV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.938	0.271
RatSA	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.275
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3i: Matrix nucleotide identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.358	0.336	0.326	0.334	0.344	0.188	0.189	0.179	0.183	0.183	0.210	0.173
229E	---	1.000	0.336	0.335	0.304	0.328	0.333	0.196	0.204	0.187	0.190	0.188	0.199	0.173
PEDV	---	---	1.000	0.277	0.244	0.272	0.270	0.163	0.168	0.160	0.160	0.158	0.184	0.178
TGEV	---	---	---	1.000	0.761	0.963	0.897	0.220	0.223	0.200	0.202	0.200	0.232	0.192
FeCoV	---	---	---	---	1.000	0.756	0.763	0.209	0.212	0.185	0.187	0.189	0.218	0.185
CaCoV	---	---	---	---	---	1.000	0.879	0.215	0.228	0.202	0.204	0.202	0.230	0.192
RSDAC	---	---	---	---	---	---	1.000	0.894	0.221	0.196	0.198	0.196	0.216	0.196
MHV	---	---	---	---	---	---	---	1.000	0.894	0.693	0.697	0.697	0.285	0.200
PHEV	---	---	---	---	---	---	---	---	1.000	0.680	0.684	0.682	0.282	0.208
OC43	---	---	---	---	---	---	---	---	---	1.000	0.948	0.953	0.261	0.195
BoCoV	---	---	---	---	---	---	---	---	---	---	1.000	0.973	0.261	0.197
SARS	---	---	---	---	---	---	---	---	---	---	---	1.000	0.266	0.197
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

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AAAATACCGAGGAACAATACTATAAAAGAAACACAACCGTTACTGGAAATAATTTGACTAAGTTAACACAAATGAACAGTAATAAAAAA 25300
I L W L L V M I F F F V L A M T F I K L I O L C F T C H Y F F
E

AGTAGGACATTATATCAACCAGTTTATAAAATTTTCTTGCTTACCAAGATTATATGCAAATAGCACCTGTTCCAGCTGAAGTACTAAATGT
TCATCCTGTAATATAGTTGGTCAAATATTTAAAAAGAACGAATGGTCTAATATACGTTTATCGTGGACAAGGTCGACTTCATGATTTACA 25392
S R T L Y O P V Y K I F L A Y O D Y M O I A P V P A E V L N V
E

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GATTGATTGCTACAGATTATCATCACCGGAGAAAGTCTCCAAATACAGGTAATGCATTGACCTTGAAATCAACCTTAAATTAAGATTG 25484
-E- M S N S S V P L S E V Y V H L R N W N F S W N L I L T
M

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TCAAAATATCAACACAACGTCATACCGTAATATTATATCGTCTGAAGAAATACCAATTTCTACAGACAAAATACCACAAATACCGGTG 25576
V F I V V L O Y G H Y K Y S R L L Y G L K M S V L W C L W P
M

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AACAAGATCGAAACAGATAAAACTGACAAAACAGTTAAATACACCTGACCCAGAAAAACCAAAATCATAAGAATACAGATAAATGT 25668
L V L A L S I F D C F V N F N V D W V F F G F S I L M S I I T
M

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GAAACAAATACCAATACATAAAACAAATATCAAAGTCTGAAACCGCGGCACAAATTTGAAAAACCGAAATAGGACTTTGATTACGTTA 25760
L C L W V M Y F V N S F R L W R R V K T F W A F N P E T N A I
M

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I S L O V Y G H N Y Y L P V H A A P T G V T L T L L S G V L
M

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AACAACCTACCGGTATTCTAACGATGAGCACAAGTTCACCCAGTCAACGGATTTATACATTATCAACGATGTGGATCATGGTGTAAACAACA 25944
L V D G H K I A T R V O V G O L P K Y V I V A T P S T T I V C
M

GACCGTGTGGTCGCTCTGTTAATGAAACAAGCCAGACTGGTTGGGCATTCTACGTCCTGCTAAACATGGTGATTTTCTGGTGTGCTC
CTGGCACAACCGAGGAGACAATTACTTTGTTGGTCTGACCAACCGTAAGATGCAGGCAGGATTGTACCACTAAAAAGACCACAACGGAG 26036
D R V G R S V N E T S O T G W A F Y V R A K H G D F S G V A S
M

TCAGGAGGGTGTGTTGTCAGAAAGAGAGAAGTTGCTTCATTTAATCTAACTAAACAAAATGGCTAGTGTAATTGGGCCGATGACAGAGCT
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Q E G V L S E R E K L L H L I . M A S V N W A D D R A
M N

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CGATCCTTCTTTAAAGGAGGAGGAAGTAAATGTACGGAGAAAACCAATCAAGACTATTCGGTGTATATCCAGTAAGGGTCTTAGAACA 26220

A R K K F P P P S F Y M P L L V S S D K A P Y R V I P R N L V
N

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P J G K G N K D E D I G Y W N V Q E R W R H R R G O R V D L
N

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P P K V H F Y Y L G T G P H K D L K F R O R S D G V V W V A K
N

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CTTCCACGATTTTGACAATTATGGTCAGAACCATAGCGTTTGCAATAGTCTTTGGAACCTTGGTTTCAAGAGATAACGAAACGGAGGCT 26496

E G A K T V N T S L G N R K R N O K P L E P K F S I A L P P E
N

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CGAGAGACAACAACCTCAACTCCTAGCGAGATTATTGAGTAGAGCAGCATGTCAGCAAGAAGTTGAGCATTGTTGAGTGCTTGAGAAGAG 26588

L S V V E F E D R S N N S S R A S S R S S T R N N S R D S S
N

GTAGTACTTCAAGACAACAGTCTCGCACTCGTTCTGATTCTAACAGTCTTCTTCAGATCTTGTGCTGCTGTTACTTTGGCTTTAAAGAAC
CATCATGAAGTTCTGTTGTCAGAGCGTGAGCAAGACTAAGATTGGTCAGAAGAAGTCTAGAACAACGACGACAATGAAACCGAAATTTCTTG 26680

R S T S R O O S R T R S D S N O S S S D L V A A V T L A L K N
N

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L G F D N O S K S P S S S G T S T P K K P N K P L S O P R A D
N

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K P S O L K K P R W K R V P T R E E N V I O C F G P R D F N
N

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TGTATACCCCTAAGTCTAGAACAAAGTCTTACCACAACACGGTTCCCAAAGGTGTCGAACGACTTAACCTAAGGATTAGTCCGACGCAAT 26956

H N M G D S D L V O N G V D A K G F P O L A E L I P N Q A A L
N

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F F D S E V S T D E V G D N V Q I T Y T Y K M L V A K D N K N
N

CCTTCCTAAGTTCATTGAGCAGATTAGTGCTTTTACTAAACCCAGTTCTATCAAGAAATGCAGTCACAATCATCTCATGTTGCTCAGAACA
GGAAGGATTCAAGTAACTCGTCTAATCACGAAATGATTGGGTCAAGATAGTTTCFTTACGTCAGTGTTAGTAGAGTACAACGAGTCTTGT 27140

L P K F I E Q I S A F T K P S S I X E H O S O S S H V A O N
N

CAGTACTTAATGCTTCTATTCCAGAATCTAAACCATGGCTGATGATGATTCAGCCATTATAGAAATGTCAACGAGGTTTGCATTAATT
GTCATGAATTACGAAGATAAGGCTTAGATTGGTAACCGACTACTACTAAGTCGGTAATATCTTTAACAGTTGCTCCAAAACGTAATTTAA 27232

T V L N A S I P E S K P L A D O D S A I I E I V N E V L H . 3'
N

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CAAAACATTAAAGTCAACTTACAAATAATAATAATCAACGTTGGGTACGCAATCGCGTACTATTCCCAAATCAGAATGTGTGTACCATC 27324

3'UTR

GCCAGTGATAGTAAAGTGAAGTAATTTGCTATCATATTAACATGTCTAGAGGAAAGTCAGAACTTTTCTGTTTGTGTTGTTGGAGTACTT
CGGTCATATCATTTACATTCTTAACGATAGTATAATTGTACAGATCTCCTTTCAGTCTTGAAAAAGACAAACACAACCAACCTCATGAA 27416

3'UTR

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TTTCTAGCGTATCCGCGGGTGTACCTTCTCGGTGTGTATAGATTTTACAAAACAGACCATGAACAATTACTATAACAAAACTATA 27508

3'UTR

GGATACACAAAAAAAAAAAAAA
CCTATGTGTTTTTTTTTTTTTTT 27532

3'UTR

Fig. 2A

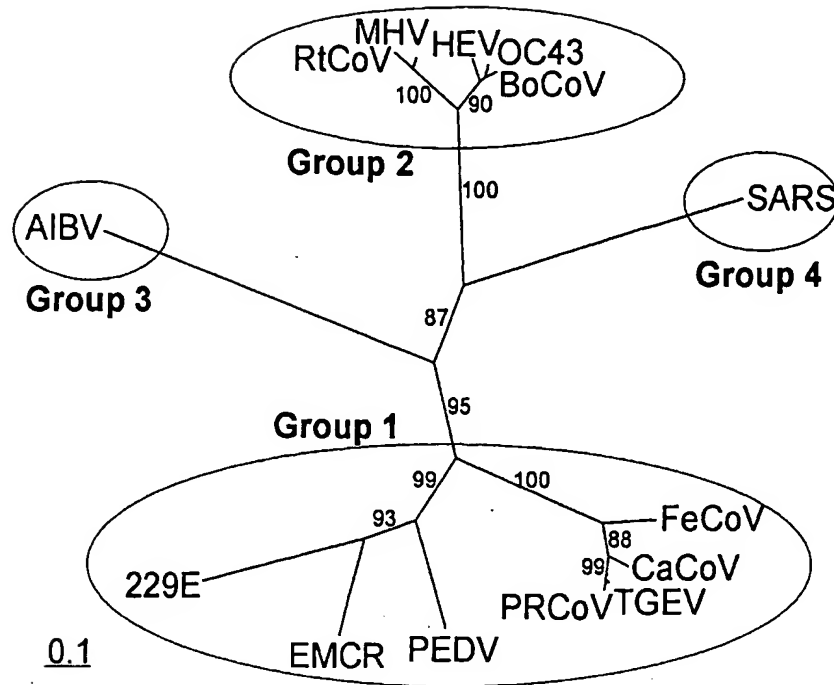


Fig. 2B

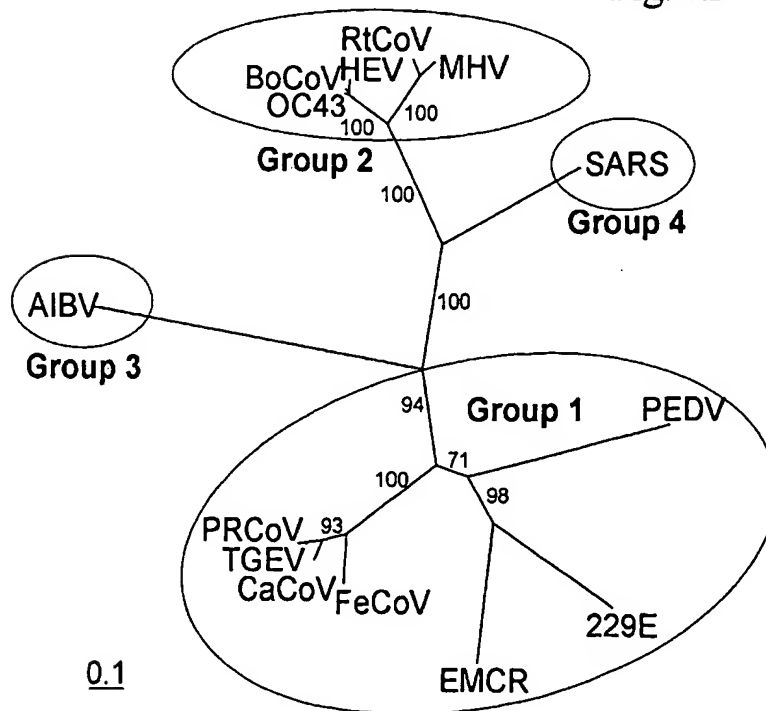


Fig. 3a: Putative Orf 1a Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OC43	BoCoV	MHV	AIPV	SARS
EMCR	1.000	0.566	0.491	0.371	0.211	0.213	0.215	0.185	0.194
229E	---	1.000	0.475	0.379	0.211	0.211	0.209	0.191	0.194
PEDV	---	---	1.000	0.366	0.208	0.208	0.204	0.183	0.192
TGEV	---	---	---	1.000	0.204	0.204	0.199	0.182	0.186
OC43	---	---	---	---	1.000	0.964	0.656	0.182	0.255
BoCoV	---	---	---	---	---	1.000	0.659	0.186	0.255
MHV	---	---	---	---	---	---	1.000	0.178	0.253
AIPV	---	---	---	---	---	---	---	1.000	0.178
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3b: Putative Orf 1b Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	BoCoV	OC43	MHV	AIPV	SARS
EMCR	1.000	0.815	0.778	0.711	0.504	0.517	0.523	0.516	0.550
229E	---	1.000	0.765	0.720	0.504	0.520	0.515	0.515	0.546
PEDV	---	---	1.000	0.728	0.522	0.538	0.531	0.523	0.552
TGEV	---	---	---	1.000	0.517	0.533	0.529	0.520	0.551
BoCoV	---	---	---	---	1.000	0.953	0.832	0.519	0.591
OC43	---	---	---	---	---	1.000	0.857	0.534	0.611
MHV	---	---	---	---	---	---	1.000	0.532	0.606
AIPV	---	---	---	---	---	---	---	1.000	0.541
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3c: Putative Orf 1ab Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OV43	BoCoV	MHV	AIBV	SARS
EMCR	1.000	0.666	0.605	0.503	0.314	0.310	0.316	0.314	0.326
229E	---	1.000	0.592	0.510	0.320	0.314	0.316	0.311	0.326
PEDV	---	---	1.000	0.509	0.326	0.320	0.323	0.313	0.328
TGEV	---	---	---	1.000	0.317	0.311	0.313	0.311	0.320
OV43	---	---	---	---	1.000	0.961	0.734	0.312	0.408
BoCoV	---	---	---	---	---	1.000	0.725	0.307	0.400
MHV	---	---	---	---	---	---	1.000	0.309	0.404
AIBV	---	---	---	---	---	---	---	1.000	0.312
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3d: Putative Spike protein Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	MHV	Rat C	PHEV	AIBV	SARS
EMCR	1.000	0.547	0.442	0.387	0.386	0.394	0.393	0.205	0.206	0.196	0.198	0.203	0.202	0.167
229E	---	1.000	0.412	0.383	0.381	0.383	0.445	0.178	0.185	0.178	0.174	0.179	0.230	0.176
PEDV	---	---	1.000	0.412	0.412	0.415	0.403	0.193	0.188	0.189	0.189	0.194	0.198	0.179
TGEV	---	---	---	1.000	0.787	0.802	0.812	0.196	0.195	0.199	0.202	0.197	0.188	0.171
CaCoV	---	---	---	---	1.000	0.911	0.743	0.196	0.195	0.202	0.202	0.194	0.184	0.167
FeCoV	---	---	---	---	---	1.000	0.758	0.195	0.193	0.197	0.200	0.196	0.188	0.167
Por R	---	---	---	---	---	---	1.000	0.183	0.185	0.189	0.191	0.186	0.212	0.164
OC43	---	---	---	---	---	---	---	1.000	0.911	0.637	0.637	0.803	0.171	0.254
BoCoV	---	---	---	---	---	---	---	---	1.000	0.642	0.643	0.817	0.173	0.255
MHV	---	---	---	---	---	---	---	---	---	1.000	0.909	0.643	0.183	0.249
Rat C	---	---	---	---	---	---	---	---	---	---	1.000	0.646	0.184	0.255
PHEV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.177	0.252
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.164
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3e: Putative OrfE Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	PHEV	MHV	Rat C	AIBV	SARS
EMCR	1.000	0.467	0.415	0.292	0.304	0.256	0.304	0.154	0.154	0.154	0.181	0.181	0.092	0.179
229E	---	1.000	0.532	0.243	0.231	0.243	0.231	0.214	0.214	0.214	0.227	0.227	0.120	0.230
PEDV	---	---	1.000	0.280	0.268	0.256	0.280	0.214	0.214	0.214	0.227	0.227	0.092	0.179
TGEV	---	---	---	1.000	0.914	0.743	0.963	0.172	0.172	0.172	0.172	0.172	0.145	0.228
CaCoV	---	---	---	---	1.000	0.804	0.926	0.172	0.172	0.172	0.193	0.193	0.127	0.216
FeCoV	---	---	---	---	---	1.000	0.756	0.183	0.183	0.183	0.182	0.182	0.127	0.204
Por R	---	---	---	---	---	---	1.000	0.183	0.183	0.183	0.172	0.172	0.136	0.216
OC43	---	---	---	---	---	---	---	1.000	0.976	0.988	0.644	0.655	0.119	0.176
BoCoV	---	---	---	---	---	---	---	---	1.000	0.988	0.622	0.633	0.110	0.176
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.633	0.644	0.119	0.176
MHV	---	---	---	---	---	---	---	---	---	---	1.000	0.977	0.128	0.191
Rat C	---	---	---	---	---	---	---	---	---	---	---	1.000	0.128	0.202
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.137
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 4 Alignments

a. 5' untranslated region (Genomic sequence) aligned with human coronavirus 229E

	5 15 25 35 45 55
EMCR5'UTR	-----AGATAGA GAATTTTCTT ATTTAGACTT TGTGTCTACT
229E5'UTR	ACTTAAGTAC CTTATCTATC TACAGATAGA AAAGTTGCTT -TTTAGACTT TGTGTCTACT

	65 75 85 95 105 115
EMCR5'UTR	CCTCTCAACT AAACGAAATT TTT-CTAGTG CTGTCAATTG TTATG--GCA GTCCTAGTGT
229E5'UTR	TTTCTCAACT AAACGAAATT TTTGCTATGG CCGGCATCTT TGATGCTGGA GTCGTAGTGT

	125 135 145 155 165 175
EMCR5'UTR	AATTGAAATT TCGTCAAGTT TGTAA-ACTG GTTAGGCAAG TGTTGTATTT TCTGTGTTTA
229E5'UTR	AATTGAAATT TCATTGGGT TGCAACAGTT TGAAGCAAG TGCTGTGTGT CCTA-GTCTA

	185 195 205 215 225 235
EMCR5'UTR	AGCACTGGTG GTTCTGTC-C ACTAGTGCAC AC-ATTGATA CTTAAGT-GG TGTCTGTCA
229E5'UTR	AGGGTTTCGT GTTCCGTCAC GAGATTCAT TCTACAAACG CCTTACTCGA GGTTCGCTCT

	245 255 265 275 285
EMCR5'UTR	CTGCTTATG TGGAAGCAAC GTTCTGTCGT TGTGGAACCC AATAACTGCT AACC
229E5'UTR	CGTGTGTTGTG TGGAAGCAAA GTTCTGTCTT TGTGGAACCC AGTAACTGTT CCTA

b. Putative Orf 1a

	5 15 25 35 45 55
EMCR	-----MFYNQVT LAVASDSEIS GFGFAIPSPA VRAYSEAAQ GFQACRFVAF
229E	-----MACNRVT LAVASDSEIS ANGCSIAQA VRRYSEAAAS GFRACRFVSL
PEDV	-----MASNHVT LAFANDAEIS AFGFCTASEA VSYSEAAAS GFMCRCRFVSL
TGEV	-----MSSKQFK ILVNEDYQVN VPSLPIR-DV LQEIKYCYRN GFEGYVFVPE
OC43	MSKINKYGLE LHWAEFFPWW FEDAEKLDN PSSSEVDMIC STTAQKLETD GICPENHVMV
BoCoV	MSKINKYGLE LHWAEFFPWW FEDAEKLDN PSSSEVDIVC STTAQKLETD GICPENHVMV
MHV	MAKMGKYG LG FKWAPEFPWW LPNASEKLGS PERSEEDGFC PSAAQEPKTK GKTLINEHVRV
AIPV	-----MASSLKQ GVSPKPRDVI LVSKDIPEQL CDALFFYTSH NPKDYADAF
SARS CoV	-----MESLVLG VNEKTHVQLS LPVLQVRDVL VRGFGDSVEE ALSEAREHLK

	65 75 85 95 105 115
EMCR	GLQDCVTGIN DDD-YVIALT GTNQLCAKIL LFSDRPLNLR GWLIFSNSNY VLQDFDVVFG
229E	DLQDCIVGIA DDT-YVMGLH GNQTLFCNIM KFSDRPFMLH GWLVFSNSNY LLEEFDVVFG
PEDV	DLADTVEGLL PED-YVMVVI GTTKLSAYVD TFGSRPRNIC GWLLFSNCNY FLEELELTFG
TGEV	YCRDLVDCDR KDH-YVIGVL GNGVSDLKPV LLTEPSVMLQ GFIVRANCNG VLEDFDLKIA
OC43	DCRRLLKQEC CVQSSLIREI VMNASPYDLE VLLQDALQSR EAVLVTTPLG MSLEACYVRG
BoCoV	DCRRLLKQEC CVQSSLIREI VMNTRPYDLE VLLQDALQSR EAVLVTPPLG MSLEACYVRG
MHV	DCSRLPALEC CVQSAIIRDI FVDEDPLNVE ASTMMALQFG SAVLVKPSKR LSIQAWAKLG
AIPV	VRQKFDRSLQ TGKQFKFETV CGFLFLKGVD KITPG----- VPAKVLKATS KLADLEDIFG
SARS CoV	NGTCGLVELE KGVLPQLEQP YVFIKRS DAL STNHGHKVVE LVAEMDGIQY GRSGITLGV

	125 135 145 155 165 175
EMCR	--HGAGSVVF VDKYMGCFDG KPVLPKNMWE FRDYFENDNTD S-IVIGGVTY QLAWDVIRKO
229E	K-RGGGNVTY TDQYLCGADG KPVMSIEDLMQ FVDHFEENEE --IIINGHTY VCAWLTKRKP
PEDV	--RRGGNIYP VDQYMGADG KPVLQSEWE YTDFFADSED GQLNIAGITY VKAWIVERSD
TGEV	--RTGRGAIY VDQYMGADG KPVIEG---D FKDYFGDED- --IIEFEGEY HCWATTVRDE
OC43	C-NPRGWTMG LFRRRSVCNT GRCTVNKHVA YQLYMIDPAG ---VCLGAGO FVGWVIPLAF
BoCoV	C-NPNGWTMG LFRRRSVCNT GRCAVNKHVA YQLYMIDPAG ---VCFGAGO FVGWVIPLAF
MHV	V-LPKTPAMG LFKRFCLCNT RECVCDAHVA FQLFTVQPDG ---VCLGNR FIGWFVPVTA
AIPV	VSPLARKYRE LLKTACQWSL TVEALDVRAQ TLDEIFDPT- ----- EILWLQVAAK
SARS CoV	VPHVGETPIA YRNVLLRKNG NKGAGGHSYG IDLKSVDLGD ELGTDPIEDY EQNWNTKRG

	185	195	205	215	225	235
EMCR	LSYEQQNVLA	IESIHYLG-T	TGHTLKSCK	LINAKPPKY-	--SSKVVLSG	EWNAVYKAFG
229E	LDYKQNNLA	IEEIEYVHGD	ALHTLRNGSV	LEMAKEVKT-	--SSKVVLSG	ALDKLYKVFG
PEDV	VSYASQNLTS	IKSITYCS-T	YEHTFLOGTA	MKVARTPKI-	--KKNVVLSE	PLATIYREIG
TGEV	KPLNQOTLFT	IQEIQYNL-D	IPHKLPNCAT	RHVAPPVKK-	--NSKIVLSE	DYKKLYDIFG
OC43	MPVQSRKFIV	PWVMYLRKRG	EKGAYNKDHG	RGGFH----	--VYDFKVED	AYDQVHDEPK
BoCoV	MPVQSRKFIA	PWVMYLRKCG	EKGAYIKDYK	RGGFH----	--VYNFKVED	AYDLVHDEPK
MHV	IPAYAKQWLQ	PWSILLRKGG	NKGSVTSGHF	RRAVTMP----	--VYDFNVED	ACEEVHLNPK
AIPV	IHVSSMAMRR	LVGEVTAKVM	DALGSNLSAL	FQIVKQ----	--QIARIFQK	ALAIFFENVNE
SARS CoV	GALRELTREL	NGGAVTRYVD	NNEFCGPDGYP	LDCIKDFLAR	AGKSMCTLSE	QLDYIESKRG
	245	255	265	275	285	295
EMCR	SPFITNGISL	LDIIVKPVFF	NAFVKNCNGS	ENWSVGAWDG	YLSGCCGTPA	KKLCVVPGNV
229E	SPVMTNGSNI	LEAFTKPVFI	SALVQCTCGT	KSWSVGDWGT	FKSSCCNVIS	NKLCVVPGNV
PEDV	SPFVDNGSDA	RSIIRPVFL	HAFVKCKCGS	YHWTGVDWTS	YVSTCCGFKC	KPVLVASCSSA
TGEV	SPFMNGDCL	SRCFDTLHFI	AATLRCPGCS	ESSGVGDWGT	FKTACCGLSG	KVKGVTLGDI
OC43	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCDO	TGSLADGLEA	YADKTLOEMK	ALFPTWSQEL
BoCoV	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCDO	TGSLADGLEA	YADKTLOEMK	ALFPTWSQEL
MHV	GKYSKKAYAL	LKGYRGVXSI	LFLDQYGCDO	TGRLAKGLED	YGDCTLEEMK	ELFPVWCDSL
AIPV	LPQRIAAALM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE	ELPNGFMGSK
SARS CoV	VYCCRDHEHE	IAWFTERSDK	SYEHQTPFEI	KS--AKKFD	FKGECPRFVF	PLNSKVVKVIQ
	305	315	325	335	345	355
EMCR	VPGDVIITST	DAGCGVXYA	GLVVKHITNI	TGVSLWRVTA	VHSDGMFVAT	SSYDALLHRN
229E	KPGDAVITTO	QAGAGIRYFC	GMTLKEVANI	EGSVVWRVIA	LQSVDCFVAS	STFEVEEHN
PEDV	MPGSVVVTRA	GAGTGKYYN	NMFLRHVADI	DGLAFWRILK	VQSKDDLACS	GKFLHHEEG
TGEV	KPGDAVVTSM	SAGKGVKFFA	NCVLQYAGDV	EGSVIWKVIK	TFTVDETVC	PGFEGELN--
OC43	LFDVIVAWHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLDCGS	VVIKEPVHVV
BoCoV	PFDVTVAWHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLDCGS	VVIKEPVHVV
MHV	DNEVVVAWHV	DRDP----RA	VMRLQTLATI	R---SIGYVG	QPTEDLDVGD	VVREPAHLL
AIPV	IFTTLAFFKE	AAVR-----	-VVENIPNAP	RGTKGFVEVG	NAKGTQVVVR	GMRNDLTLLD
SARS CoV	PRVEKKKTEG	FMGRIRSVYP	VASPQECNNM	HLSTLMKCNH	CDEVSWQTC	FLKATCEHCG
	365	375	385	395	405	415
EMCR	SLDPFCFDVN	TLLSNQLRLA	FLGASVTEVD	KFAASTGVID	ISAGMFGLYD	DILTNNKPWF
229E	RMDTFCFNVR	NSVTDECLA	MLGAEMTSNV	RRQVASGVID	ISTGWFDVYD	DIFAESKPWF
PEDV	FTDPCYFLND	SSLATKLKFD	ILSGKFSDEV	KQAIAGHVV	VGSALVDIVD	DALG--QPWF
TGEV	--DFIKPESK	SLVACSVKRA	FITGDIDDAV	HDCIITGKLD	LSTNLFNGVG	LLFKK--TPWF
OC43	ADDSIILRQY	NLVDIMSHFY	MEADTVVNAF	YGVALKDCGF	VMQFGYIDCE	QDSCDFKGWI
BoCoV	ADDSIILRQH	NLVDIMSCFY	MEADAVVNAF	YGVOLKDCGF	VMQFGYIDCE	QDLCDFKGWV
MHV	ANAIAVKRLP	RLVETMLYTT	--DSSVTEFC	YKTKLDCDGF	ITQFGYVDCC	GDACDFRGWV
AIPV	QKADIPVEPE	GWSAILDGH	CYVFRSGDRF	YAAPLSGNFA	LSDVHCCEV	VCLSDGVTPPE
SARS CoV	-TENLVIEGP	TTCGYLPTNA	VVMPCPCACQ	DPEIGPEHSV	ADYHNHNSIE	TLRL--KGG
	425	435	445	455	465	475
EMCR	VRKASGLFDA	IWDAFVAAIK	LVPTTTGGLV	RFVKSIASTV	LTVSNGVIIM	CADVDPDAFQ
229E	VRKAEDIFGP	CWSALASALK	QLKVTGTGLV	RFVKSICNSA	VAVVGTTIQI	LASVPEKFLN
PEDV	IRKLGLDASA	PWEQLKAVVR	GLGLLSDEVV	LFGKRLSCAT	LSIVNGVFEF	LADVPEKLAA
TGEV	VQKCGALFVD	AWKVVEELCG	SLTLTYKQIY	EVVASLCTSA	FTIVNYKPTF	VVPD--NRVKD
OC43	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
BoCoV	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
MHV	PGNMMDGFLC	PGCSKSYMPW	ELEAQSSGVI	PKGGVLTQTS	TDTVN-----	---RESFKL
AIPV	INDGLILAAI	YSSFSVSELV	TALKKGEPEK	FLGHKFEVYK	DAAVS-----	---FTL
SARS CoV	TRCFGGCVFA	YVGCYNKRAY	WVPRASADIG	SGHTGITGON	VETLN-----	---EDLLEILS
	485	495	505	515	525	535
EMCR	VYRTFTQAIC	AAFDFSLDVF	KIG---DVKE	KRLGDYVLTE	NALVRLTTEV	VRGVDRARIK
229E	AFDVFVTAIQ	TVFDCAVETC	TIA---GKAF	OKVFDYVLLD	NALVKLVTTK	LKGVREERGLN
PEDV	AVTVFVNFLN	EFFESACDCL	KVG---GKTF	NKVGSYVLFD	NALVKLVRAK	ARGPROAGIC
TGEV	LVDKCVKVLV	KAFDVFTQII	TIAGIEAKCF	VLGAKYLLFN	NALVKLVSVK	ILGKKQKGLE
OC43	YGQTVVYFVG	CVYWSPARNI	WIP---ILKSS	VKSYSYDLVY	GVVGCKAIVK	ETNLICKALY
BoCoV	YGQTVVYFVG	CVYWSPARNI	WIP---ILKSS	VKSYSYDLVY	GVVGCKAIVK	ETNLICKALY
MHV	YGHAVVPFGS	AVYWSPPYGM	WLP---VIWSS	KSYADLTYY	GVVGCKAIVQ	ETDAICRSIY
AIPV	AKAATIADVL	RLFQSARVIA	EDVWS-SFTE	KSEFFWKLAY	GKVRNLEEFV	KTYVCKAQMS
SARS CoV	RERVNINIVG	DFHLNEEVAI	ILAS-FSAST	SAFIOTIKSL	DYKSFKTIVE	SCGNKYVTKG
	545	555	565	575	585	595
EMCR	KAMFTKVVVG	PTTEVKFSVI	ELATVNLRLV	DCAPVVCPRG	KIVVIAGQAF	FYSGGGYRFM
229E	KVKYATVVVG	STEEVKSSRV	ERSTAVLTIA	NNYSKLFDEG	YTVVIGDVAI	FVSDGYFRML
PEDV	EVRYTSLVVG	STTKVVSXRV	ENANVNLVVV	DEDVTLNTTG	RTVVVDGLAF	FESDGYFRHL
TGEV	CAFFATSLVG	ATVNVTPKRT	ETATISLNKV	DDVVAPG-EG	YIVIVGDMAF	YKSGEYFFMM
OC43	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLLEN	IDYFNMRRAK	FSLETFTVCA
BoCoV	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLLEN	IDYFNMRRAK	FSLETFTVCA
MHV	MDYVQHKCGN	LEQRAILGLD	DVYHRLQLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FATCG
AIPV	IVILAAVLGE	DIWHLVSVQI	YKLGVLFTKV	VDFCDKHWKG	FCVQLKRAKL	IVTETFCVLK
SARS CoV	KPVKGAWNIG	QQRSVLTPLC	GFPSQAAGVI	RSIFARTLDA	ANHSIPDLQR	AAVTILDGIS

	605	615	625	635	645	655
EMCR	VDSSTVLNDP	VFTGELEYTI	KFSGFKLDGF	N-----H	QFVNASSATD	AIIAVELLS
229E	ASPNVSLTTA	VYKELFAFNV	NVMGTRPE--	-----	KFPTTVCEN	LESAVLVND
PEDV	ADADVIEHP	VYKSACELKP	VFECDPIP--	D-----F	PLPVAASVAE	LCVQTDLLK
TGEV	SSPNFVLTNN	VFKAVKVPST	DIVYDVNDT	KSKMIARLGS	SFEYDGDIDA	AIVKVNELLI
OC43	DGFMFLLDD	LVPRAYYLAV	SGQAFCDY--	-----	ADKLCHAVVS	KSKELLDVSL
BoCoV	DGFMFLLDD	LVPRAYYLAV	SGQAFCDY--	-----	AGKICHAVVS	KSKELLDVSV
MHV	DGLVPLLLDG	LVPRAYYLAV	SGQAFCDY--	-----	MVNFSEHVD	MCMDMLLFM
AIPV	GVAQHCFQLL	LDIAHSLYKS	FKKCALGR--	-----	IHGDLF	WKGGVHKLIV
SARS CoV	EQSLRLVDM	VYTSDDLNS	VIIMAYVTG-	-----	GLVQQTQ	WLSNLLGTTV
	665	675	685	695	705	715
EMCR	DEKTAFFVYT	CVVDGCSVIV	RRDAT-FATH	VCFKDCYSIW	EQFCIDNCGE	PWFLTDYNAI
229E	KITEFQLDYS	IDVIDNEIIV	KPNIS-LCVP	LYVRDYVDKW	DDFCRQYSNE	SWFEDDYRAF
PEDV	NYNTPYKTYT	CVVRGDKCCI	TCTLQ-FKAP	SYVEDAVN-F	VDLCTKNIGT	AGFHEFYITA
TGEV	EFRRQSLCFR	AFKDDKSIFF	EAYFKYKMP	ACLAKHIG-L	WNIKKDSCK	RGFLNLFNHL
OC43	DSLGAIIHYL	NSKIVDLAQH	FSDFG-----	TSFVSKIVHF	FRTFTTSTAL	AFAWVLHFVL
BoCoV	DSLGAIIHYL	NSKIVDLAQH	FSDFG-----	TSFVSKIVHF	FRTFTTSTAL	AFAWVLHFVL
MHV	HDKVATKYV	KKVTGKLAVR	FKALG-----	VAVVRKITET	FDLAVDTAAS	AAGWLCYQLV
AIPV	DGDEIWFDAI	DSVDVEDLGV	VQEKSD-ID	FEVCDVTLF	ENQPGHMQI	EDDGKNYMF
SARS CoV	EKLRFIFEWI	EAKLSAGVEF	LKDAW-----	EILKFLITGV	FDIVKGQIQV	ASDNKDCVK
	725	735	745	755	765	775
EMCR	LQSNPQCAI	VQASESK--V	LLERFLPKCP	EILLSIDGHI	LWNLFVEKFN	FVTDWLKTLK
229E	ISVLDITDAA	VKAAESK--A	FVDITVPPCP	SILKVIDGGK	IWNGVIKNVN	SVRDWLKSLK
PEDV	HEQQDLQGLT	TTCCMSGFE	CFMPTIPQCP	AVLEEIDGGS	IWRSFITGLN	TMWDFCKRLK
TGEV	NELEDIKETN	IQAIKN----	-----ILCP	DPLLDLDYGA	IWYNCMPGCS	DP-SVLGSVQ
OC43	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKVV	LDSLRTVTFID	GLSCFKIGRR
BoCoV	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKVV	LDSLRTVTFID	GLSCFKIGRR
MHV	NGLFAVANGG	ITFLSD----	-VPELVKFN	DKFKVFFKVL	IDMSVSVSL	GLTVVKTASN
AIPV	RFKDENIYY	TPMSQLG----	-AINVVCCK	AGGKTVTFG-	---ETTQEIIP	PPDVPVIVKS
SARS CoV	CFIDVVKAL	EMCIDQ----	-----VTIAG	AKLRLNLGE	VFIAQSKGLY	RQCIRGKEQL
	785	795	805	815	825	835
EMCR	LTLSNGLLG	NCAKRFRRVL	VKLLDVYNGF	LETVCVVVHT	AGVCIKYAV	NVP-YVVISG
229E	LNLTOQQLG	TCAKRFKRWL	GILLEAYNAP	LDTVVSTVKI	GGLTFKTYAF	DKP-YIVIRD
PEDV	VSGLDGIUV	TVARKFKRLG	ALLAEMYNTY	LSTVVENLVL	AGVSFKYYAT	SVP-KIVLGG
TGEV	LLIGNG--VK	VVCDGCGKFA	NOLSKGYNKL	CNAARNDIEI	GGIPFSTFTK	PTNTFIEMTD
OC43	RICLSGRKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKAKQ	KPIYLKSGSG	DFSLADSVVE
BoCoV	RICLSGRKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKAKQ	KPIYLKSGSG	DFSLADSVVE
MHV	RVCLAGKVIY	EVVQKRLSAY	VMPVGCNEAT	C-----	---LVGEIE	PAVVEDDVVD
AIPV	IECCGEPWNT	IFKRAYKEPI	EVDTDLTVEQ	LLSVIYKMC	DDLKLFPEAP	EPFPPFENVAL
SARS CoV	QLMLPKAPK	EVTFLGDSH	DTVLTSEEVV	LKNGELEALE	TPVDSFTNGA	IVGTPVCVNG
	845	855	865	875	885	895
EMCR	FVSRVIRRR	CD--VTFCPV	SCVTFEYFEL	DTCFVSK--	---PNAIDVEH	LELKETVFEVE
229E	IVCKVENKTE	AEWIELEFPHN	ORIKSFSTFE	SAYMPIAD--	---PTHFDIEE	VELLDAEFVE
PEDV	CFHSVKSVEA	SV--FQIPVQ	AGIEKFVKVL	NCVHPV--	---PRVIETSF	VELEETTFKP
TGEV	AIYSVIEQKG	AL-----	S-----FR	DADVPVVDNG	TISTADWSEP	ILLEPAEYVK
OC43	VVTTSLTPCG	YS-----EPP	KVADKICIVD	NVYMAKAGDK	YYPVVVD-DH	VGLLDQAWRV
BoCoV	VVTTSLTPCG	YS-----EPP	KVADKICIVD	NVYMAKAGDK	YYPVVVD-GH	VGLLDQAWRV
MHV	VVKAPLTYQG	CC-----KPP	TSFEKICVVD	KLYMAKCGDQ	FYPVVVDNDT	IGVLDQCWRF
AIPV	VDRNGDLDC	IKS-----	-----CHLI	YRDYESD--	-----DD	IEEEDAEECD
SARS CoV	LMLLEIKDKE	QY-----	-----CAL	PGLLATN--	-----NV	FRLKGGAPIK
	905	915	925	935	945	955
EMCR	PKDGGQFEVS	DDYLWYVV-D	D-----IY	YPASCVGLP	VAFTKLAGGK	---ISFSDDV
229E	PGCGGILAVI	DEHVYFKK-D	G-----VY	YPSNGTNILP	VAFTKAAGGK	---VSFSDDV
PEDV	PALNGGIAIV	DGFAFYD-G	T-----LY	YPTDGNVVP	ICFKKGGGD	---VKFSDEV
TGEV	PKNNGNVIVI	AGYTFYKDED	E-----HF	YPYGFQKIVQ	RMYNKMGGD	KT-VSFSEEV
OC43	PCAGRRVTFK	EQPTVKEIIS	MPKIKVFYE	LDNDFNTILN	TACGVFEVDD	TVDMEEFYAV
BoCoV	PCAGRCVTFK	EQPTVNEIAS	TPKTIKFYE	LDKDFNTILN	TACGEFEVDD	TVDMEEFYAV
MHV	PCAGKKEVFN	DKPKVKEIPS	T-RKIKINFA	LDATFDSVLS	KACSEFEVDK	DVTLDELLOV
AIPV	TDSGAEECD	TNSECEEEDE	D-----TK	VLALIQDPAS	IKYPLPLDED	YS-VYNGCIV
SARS CoV	GVTFGEDTVW	EVQGYKNVRI	T-----FE	LDERVDKVLN	EKCSVYTVES	GTEVTEFACV
	965	975	985	995	1005	1015
EMCR	IYHDEPETHK	VKLIFEFEED	-VVTSLCKKS	FGKSIITYG-	DWEGLEHVLT	SAMNVIG---
229E	EVKDIEPVYR	VKLCFEFEDE	-KLVDVCEKA	IGKKIKHEG-	DWDSFCKTIQ	SALSVVS---
PEDV	SVKTIIDPVYK	VSLEFEFESE	-TIMAVLNKA	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---
TGEV	DVQEIAPVTR	VKLEFEFDNE	-IVTGVLERA	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL
OC43	VIDAIEEKL	PCKELEGVGA	-KVSALQKL	EDNPLFLFD-	--EAGEEVL	PKLYCAFTAP
BoCoV	VIDAIEEKL	PCKELEGVGA	-KVSALQKL	EDNPLFLFD-	--EAGEEVL	PKLYCAFTAP
MHV	VLDVESTLS	PCKEHDVIGT	-KVCALLNRL	AEDYVYLF-	--EGGEEVIA	PKMYCSFSAP
AIPV	HKDALDVVNL	PSGEETVVN	NCFEGAVKPL	PQKVVDVLG-	--DWGEAVDA	QEQLCQ---
SARS CoV	VAEAVVKTQ	PVSDLLTN--	--MGIDLDEW	SVATFYLF-	--DAGEENFS	SRMYCSFYPP

	1025	1035	1045	1055	1065	1075
EMCR	--QHRLPQF	YIYDEEGGYD	VSKP--VMIS	QWPISDDSDG	CVVEASTDFH	Q--LESVREE
229E	--CYVNLPTY	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE
PEDV	--DHVEVPKY	YIYDEEGGTD	PNLP--VMIS	QWPLNDDTIS	QDLOVEVVT	DAPIDSEGDE
TGEV	ANQGVLEEGY	FIYDTCCGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSE	EE--VESVEED
OC43	EDDDFLEESD	VEEDDVEGEE	TDLTVTSAGQ	PCVASEQEE	SEVLEDTLDD	GPSVETSOSQ
BoCoV	EDDDFLEESG	VEEDDVEGEE	TDLTVTSAGE	PCVASEQEE	SEILEDTLDD	GPCVETSOSQ
MHV	DDEDCVAADV	VDADENQGGD	ADDSAALVTD	TQEEGQVAKG	QVGVAESDAR	LQQVEAFDIE
AIPV	--EPLQHTFE	EPVENSTGSS	KTMTEQVVVE	DQELPVVEQD	QDVVVYTPTD	LEVAKETAE
SARS CoV	DEEEEDDAEC	EEEEIDETCE	HEYGTEDDYQ	GLPLEFGASA	ETVRVEEEEEE	EDWLDDTTQ
	1085	1095	1105	1115	1125	1135
EMCR	VD-----	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----
229E	VNS-----	-----	-----	-----IFD	IETVDVVRHDV	S-----
PEDV	VDSSAPEKVA	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV
TGEV	PENIVEASE	GAGETSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDQVEAEQF
OC43	VEEDVEMS--	-----DFVDL	ESVIQD----	-----	--YENVCFEF	YTT-----
BoCoV	VEEDVQMS--	-----DFGDL	ESVIQD----	-----	--YENVCFEF	YTT-----
MHV	KVEOPILN--	-----ELSAE	LNAPADK----	-TYEDVLAFD	AIYSEALSAF	YAVP-----
AIPV	VD-----	-----	-----	-----	-----	-----
SARS CoV	SEIEPEP----	-----	-----	-----E	PTPEEPVNQF	TG-----
	1145	1155	1165	1175	1185	1195
EMCR	---PFSFSFR	DELGVRLDQ	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VKGVDIVQK
229E	---PFEMPFE	ELNGLKILKQ	LDNNCWVNSV	MLQILQTLGIL	DGDYAMOFFK	MGRVAKMIER
PEDV	TKOPFAFDV	SYGGLKVLRLQ	SHNNCWVTST	LVQLQLLGIV	DDP-AMELFS	AGRVGPMVRK
TGEV	NPSLPPFKTT	NLNGKILKQ	GDNNCWINAC	CYQLQAFDFF	NNE-AWEKFX	KGDVMDVFNL
OC43	-----EPEFV	KVLGLYVPKA	TRNNCWLRSV	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQYQS
BoCoV	-----EPEFV	KVLGLYVPKA	TRNNCWLRSV	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQYQS
MHV	-----GDETHF	KVCGFYSPAI	ERTNCWLRST	LIVMQSLPLE	FKD--LEMQR	LWLSYKSSYN
AIPV	-----EFILIFAVPK	EEVVSQKDG	QIKQEPQV	KPQ--REKKA	KKFKVKPATC	KATNGAMQK
SARS CoV	-----YKLTD	NVAIKCDIV	KEAQSANPMV	IVNAANIHLK	HGGGVAGALN	KATNGAMQK
	1205	1215	1225	1235	1245	1255
EMCR	CYELSHLISG	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGC	FWIMPYTKLF
229E	CYTAEQCIRG	AMGDVGLCMY	RLKDLHTGF	MVMDYKCSCT	SGRLEESGAV	LFCTPTKKAF
PEDV	CYESQKAILG	SLGDVSACLE	SLTKDLHTLK	ITCSVVC CGG	TGERIYEGCA	FRMTPTLEPF
TGEV	CYAATTLARG	HSGDAEYLL	LMLNDYSTAK	IVLAACKCGG	EKEIVLERAV	FKLTPLESF
OC43	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDDWQCA	YWKCIKCDLA	LKLKGLDAMF
BoCoV	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDDWQCA	YWKCIKCDLA	LKLKGLDAMF
MHV	KEFVDKLVKS	VPSIILPQG	GYVADFAYFF	LSQCSFKAYA	NWRCLKCDMD	LKLKGLDAMF
AIPV	EKPKFLEYKT	CVGDLTVVIA	KALDEFKEFC	IVNAANEHMT	HGSGVAKAIA	DFCGLDVEY
SARS CoV	SDDYIKLNGP	LTVGGSCLLS	GHNLAKKCLH	VVGPNLNAGE	DIQLLKAAYE	NFNSQDILLA
	1265	1275	1285	1295	1305	1315
EMCR	KQGECCICHK	MQTYKLVSMT	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GKGSQGHYQT
229E	PYGTCLNCNA	PRMCTIRQLQ	GTIIFVQK--	PEPVNPSFV	VKPVCSISFR	GAVSCGHYQT
PEDV	PYGACAQCAQ	VLMTHTFKSIV	GTGIFCRD--	TTALSLSLV	VKPLCAAFFI	GK--DSGHYVT
TGEV	NYGVCDCMQ	VNTRCFLSVE	GSGVFVHDIL	SKQTPAMFV	VKPVMHAVYT	GTTQNGHYMV
OC43	FYGDVVSHTC	KCGESMVLID	VDVPFTAHA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSSH
BoCoV	FYGDVVSHTC	KCGESMVLID	VDVPFTAHA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSSH
MHV	FYGDVVSHTC	KCGTGMTLLS	ADIPYTLHFG	LRDDKFCAFY	TPRKVFRAAC	VVDVNDSSH
AIPV	CEDYVKKHGP	QORLVTPSFV	KGIQCVNNV	GPRHGDNHL	EKLVAAYKNV	LVDGVNVYV
SARS CoV	LLSAGIFGA	KPLQSLQVCV	QTVRTQVYIA	VNDKALYEQV	VMDYLDNLKP	RVEAPKQEEP
	1325	1335	1345	1355	1365	1375
EMCR	NLYSFDKAID	GFGVFDIK--	-----	-----NSSV	NTVCFVDVDF	HS--VEIEAGE
229E	NIYSQNLCDV	GFGVNIQIP--	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP
PEDV	NFYDAAMAID	GYGRHQIK--	-----	-----YDTL	NTICVKDVNW	TAPLPAVDS
TGEV	DDIEHGYCVD	GMGIKPLKKR	CYTSTLFINA	NVMTRAEPK	QEFKVEKVEQ	QPIVEENKSS
OC43	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFFIIGHGMS	FSMTTFEIAQ
BoCoV	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFFIIGHGMS	FSMTTFEIAQ
MHV	AVVDG-KQID	GKVVTKFN--	-----	-----GDK	YDFMVGHGMA	FSMSAFETIAQ
AIPV	PVLSLGIFGV	DFKMSIDAMR	-----	-----EA	FEGCTIRVLL	FSLSQEHIDY
SARS CoV	PNTEDSKTEE	KSVVQKPVDF	KP-----	-----KIKACIDE	VTTLTEETKF	LTNKLFLFAD
	1385	1395	1405	1415	1425	1435
EMCR	VK-----	-----	PFAVYKNVKF	YLGDISHLVN	CVSFDVFVNA	ANENLMHGGG
229E	IKNTVDTTPK	EEFVVKERLN	AFLVHDNVAF	YQGDVDTVFN	GVDFDFVNA	ANENLAHGGG
PEDV	VVEP-----	-----VVK	PFYSYKNVDF	YQGDVDTVFN	-LPCDFVNA	ANEKLSHGGG
TGEV	IEKEEIQSPK	ND---DLIL	PFFYKAGKLSF	YQGALDVILN	FLEPDVIVNA	ANGDLKHMGG
OC43	LYG-----	-----	-SCITPNVCF	VKGDIKVS	LVKAEVVVNP	ANGHMAHGGG
BoCoV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVVNP	ANGHMAHGGG
MHV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVVNP	ANGHMAHGGG
AIPV	FD-----	-----	-----VTC	KOKTIYLTED	GVKYRSIVLK	PGDSLQFGQ
SARS CoV	INGKLYHD--	-----SQ	NMLRGEDMSF	LEKDAPYHVG	DVITSGDITC	VVIPSKKAGG

	1445	1455	1465	1475	1485	1495
EMCR	VARAIDILTE	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFNVENNVGP	RTG---KHEH
229E	LAKALDVYTK	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLRIFNVVGP	RKG---KHER
PEDV	IAKAIDVYTK	GMLQKCSNDY	IRAHGPIRVG	RGVMLE--AL	GLKVENNVGP	RKG---KHAP
TGEV	VARAIDVFTG	GKLTERSXDY	LKKNKSIAPG	NAVFENVIE	HLSVLNAVGP	RNGD--SRVE
OC43	VAKAIAVAAG	QQFVKETTDM	VSKSGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKGQSY
BoCoV	VAKAIAVAAG	QQFVKETTDM	VSKSGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKGQSY
MHV	VAGAIKAAAG	KSFIKETADM	VRNQGVCQVG	ECYESTGGNL	CKTVLNVVGP	DARGHGKQCY
AIPV	VYAKNKIVFT	ADDVEDKEIL	YVPTTDKSIL	EYYGLD---A	QKYVIYLOTL	AQKWNVQYRD
SARS CoV	TTEMLSRALK	KVPVDEYITT	YPGQCAGYT	LEEAKTALKK	CKSAFYVLPS	EAPNAKEEIL
	1505	1515	1525	1535	1545	1555
EMCR	SLLVEAYNSI	LF---ENGIP	LMPLLSCGIF	GVRIENSLKA	LFSCDINKPL	QVFVYSSNEE
229E	DLLIKAYNTI	NN---EQGTP	LTPILSCGIF	GIKLETSLEV	LLDVCNTKEV	KVFVYTDTEV
PEDV	ELLVKAYKSV	FA---NSGVA	LTPLISVGIF	SVPLEESLSA	FLACVGDHRC	KCFYCGDKER
TGEV	AKLCNVYKAI	AK---CEGKI	LTPLISVGIF	NVRLETSLOC	LLKTVNDRGL	NVFVYTDQER
OC43	VLLERVYKHL	N---NYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQVV	LVSNNQEDFD
BoCoV	ALLERVYKHL	N---KYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQVV	LVSNNQEDFD
MHV	SFLERAYQHI	N---KCDDV	VTTLISAGIF	SVPDVSLSLY	LIGVVTKNVI	LVSNNKDDFD
AIPV	NFLILEWRDG	N---CWISS	AIVLLQAAKI	RFKGFLTEAW	AKLLGGDPTD	FVAWCYASCT
SARS CoV	GTVSWNLREM	LAHAETTRKL	MPICMDVRAI	MATIQKRYKG	IKIQEGIVDY	GVRFFFTYSK
	1565	1575	1585	1595	1605	1615
EMCR	QAVLKFLDGL	DLTPVID---	-----DQDVV	-----KPFREVEGNF	SFFDCG---V	
229E	CRVKDFVSGL	VNVQKVE---	-----QPKIE	PKPVSIVKVA	PKPYRVDGKF	SYFTED---L
PEDV	EAIKYMMDGL	VDIAFKEALV	DTTPVQEDVQ	QVSQKPVLPN	FEPFRIEGAH	AFYECPNEGL
TGEV	QTIENFFS--	-----	-----	-----	-----	-----
OC43	LISKQCITAV	EG-----	-----	-----	-----	-----T
BoCoV	LISKQCITAV	EG-----	-----	-----	-----	-----T
MHV	VIEKQVTSI	AG-----	-----	-----	-----	-----T
AIPV	AKVGDFSDAN	-----	-----	-----	-----	-----
SARS CoV	EPVASIITKL	N-----	-----	-----	-----	-----S
	1625	1635	1645	1655	1665	1675
EMCR	NALDGD-IYL	LFTNSILMLD	KQGQLDTRL	NGILOQAVLD	YLATVKTVPA	GNLVLKLVVE-
229E	LCVADDKPIV	LFTDSMLTLD	DRGLALDNL	SGVLSAAIKD	CVDINKAIPS	GNLIKFDIG-
PEDV	MSLGAD-KLV	LFTNSNLDFC	SVGKCLNDVT	SGALLEAINV	FKSNKTVPA	GNCVTLDCAN
TGEV	-----	-----	-----	-----	-----	-----
OC43	KKLAERLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDDART
BoCoV	KKLAERLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDDART
MHV	KALSLOLAKN	LCRDVKFETN	ACDSLFS---	-DSCFVSSDY	VLQVEVLLRH	DIQLDDDDARV
AIPV	-----	-----	-----	-----	-----WLLA	NLAEHFDADY
SARS CoV	LNEPLVTMPI	GVYTHGFNLE	EAARCMR---	-SLKAPAVVS	VSSPDAVTTY	NGYLTSSSKT
	1685	1695	1705	1715	1725	1735
EMCR	SCTIYMCVVP	SI-NDLSFDK	NLGRCVRKLN	RLKTCVIANV	PAIDVLKLL	SSLTLTVKFV
229E	SVVYMCVVP	SE-KDKHLDN	NVQRCTRKLN	RLMCDIVCTI	PADYILPLVL	SSLTCNVSVF
PEDV	MISITMVVLP	FD-GDANYDK	NYARAVVKVS	KLKGLVLAV	DDATLYSKLS	--HLSVLGFV
TGEV	-----CSIP	-----	-----	-----	-----	-----
OC43	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECTGGIDI	CSQDKVFGYV	QOGIFNKATV
BoCoV	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECPGGIDI	CSQDKVFGYV	QOGIFNKATV
MHV	FVQAHMDNLP	AD-WRLVNKF	DSVQGVRTVK	YFECPPGEIFV	SSQKKRFGYV	QNGSFKVASV
AIPV	TNAFLKKRVS	CN-----	-----	-----CG--	-----	-----
SARS CoV	SEEHFVETVS	LAGSYRWSY	SGQRTLGVE	FLKRGDKIVY	HTLESPEVEH	LDG--EVLSL
	1745	1755	1765	1775	1785	1795
EMCR	VESNVMDVND	CFKNDNVVLK	ITEDGINVKD	VVVESSKSLG	KQLG-VVSDG	VDSFEGVLP-
229E	GELKAAEA--	-----KVITIK	VTEDGVNVHD	VTVTTDKSFE	QQVG-VIADK	DKDLSGAVPS
PEDV	STPDQVER--	FYANKSVVIK	VTEDTRSVKA	VKVESTATYG	QQIG-PCLVN	DTVVTDNKP-
TGEV	-----	-----VN	VTEDNVNHER	VSVSFDKTYG	EQLKGTVVIK	DKDVTNQLPS
OC43	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFCO	GVNVTKHKCD
BoCoV	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFCO	GVNVTKHKCD
MHV	SQIRALLAN-	-----KVDVL	CTVDGVNFRS	CCVAEGEVFG	KTIG-SVFCO	GINVTKVRCS
AIPV	-----	-----IKSYE	LRGLEACIQP	VRATNLLHFK	TQYSNCPCTG	ANNTDEVEIA
SARS CoV	OKLSLLSLR	--EVKTIKVF	TTVDNTNLHT	QLVDMSTYTG	QQFG-PTYLD	GADVTKIKPH
	1805	1815	1825	1835	1845	1855
EMCR	-INTDTVLSV	APEVDWVAFY	GFKAALFAS	LDVKPYG---	-----YPNDF	VGGFRVLGTT
229E	DLNTESELLTK	AIDVDWVEFY	GFKAADVTEAT	VDHSAFA---	-----YESAV	VNGIRVLKTS
PEDV	-VVADVAKV	VPANWOSHY	GFDAKAGEFH	LDHTGFT---	-----FPSEV	VNGRRVIKTT
TGEV	AFDVGGQVIK	AIDVDWQAHY	GFRDAAAFSA	SSHDAYK---	-----FEVVT	HSNFIVHKQT
OC43	INYKGVVFFQ	FDNLSSSEDLK	AVRSSFNFDQ	KELLAYNNML	VNCFKQWQVV	NGKYFTFKQA
BoCoV	INYKGVVFFQ	FDNLSSSEDLK	AVRSSFNFDQ	KELLAYNNML	VNCFKQWQVV	NGKYFTFKQA
MHV	AIHKGKVVFFQ	YSGLSAADLV	AVTDAFGFDE	PQLLKYNNML	G-MCKWPVVV	CGNYFAFKQS
AIPV	SLPYLLLFAT	DGPATVDCDE	DAVGTVVVFG	STNSGHCY--	-----TQA	AGQAFDNLAK
SARS CoV	VNHEGKTFEV	LPSDDTLRSE	AFEYHTLDE	SFLGRYMSAL	NHTKKWFKPQ	VGGLTSIKWA

	1865	1875	1885	1895	1905	1915
EMCR	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
229E	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
PEDV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
TGEV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
OC43	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
BoCoV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
MHV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
AIPV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE
SARS CoV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGDAAE

	1925	1935	1945	1955	1965	1975
EMCR	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
229E	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
PEDV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
TGEV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
OC43	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
BoCoV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
MHV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
AIPV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
SARS CoV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----

	1985	1995	2005	2015	2025	2035
EMCR	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
229E	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
PEDV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
TGEV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
OC43	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
BoCoV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
MHV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
AIPV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
SARS CoV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH

	2045	2055	2065	2075	2085	2095
EMCR	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
229E	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
PEDV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
TGEV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
OC43	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
BoCoV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
MHV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
AIPV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE
SARS CoV	KLSRVKFN	G-----	-----	-----	-----	RVVITNVGE

	2105	2115	2125	2135	2145	2155
EMCR	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
229E	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
PEDV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
TGEV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
OC43	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
BoCoV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
MHV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
AIPV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
SARS CoV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL

	2165	2175	2185	2195	2205	2215
EMCR	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
229E	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
PEDV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
TGEV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
OC43	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
BoCoV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
MHV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
AIPV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS
SARS CoV	FASD-----	-----	-----	-----	LSLAVTA	IVVVGCVTS

	2225	2235	2245	2255	2265	2275
EMCR	-----	-----	-----	-----	-----	-----
229E	-----	-----	-----	-----	-----	-----
PEDV	-----	-----	-----	-----	-----	-----
TGEV	-----	-----	-----	-----	-----	-----
OC43	-----	-----	-----	-----	-----	-----
BoCoV	-----	-----	-----	-----	-----	-----
MHV	-----	-----	-----	-----	-----	-----
AIPV	-----	-----	-----	-----	-----	-----
SARS CoV	-----	-----	-----	-----	-----	-----

SUBSTITUTE SHEET (RULE 26)

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	2705	2715	2725	2735	2745	2755	
EMCR	GNTFINDIA	RELGNVVKTA	VQPTAPAYVI	IDKVDFVNGF	YRLYSGDTFW	RYDFDITESK	
229E	GSTFITPEVS	RELGNITKTN	VQPTGPAYVM	IDKVEFENGFE	YRLYSCETFW	RYNFDITESK	
PEDV	GCTFINDVIA	TEVGNNVVKLN	VQPTGPATIL	IDKVEFSNGF	YYLYSGDTFW	KYNFDITDSK	
TGEV	ENTFICDEIV	RDLNSNVKQT	VYATDRSHQE	VTKVECSGDF	YRFYVGDEFT	SYDYDVKHKK	
OC43	GNTFITVEAA	LDLSKELKRP	IQPTDVAHYT	VTDVKQVGC	MRLFYDRDGO	RTYDDVNASL	
BoCoV	GNTFITVEAA	LDLSKELKRP	IQPTDVAHYT	VTDVKQVGCY	MRLFYDRDGO	RTYDDVNASL	
MHV	GNTFITHEAA	ADLSKELKRP	VNPTDSAYYL	VTEVKQVGC	MRLFYERDGO	RVYDDVSASL	
AIPV	QNTFMSPEVA	GELSEKLRH	VKPTAYAYHV	VDEACLVDDF	VNLKYKAATP	GKDSASSAVK	
SARS CoV	GSTFISDEVA	RDLSLQFKRP	INPTDQSSYI	VDSVAVKNGA	LHLFYDKAGO	KTYERHPLSH	
						
	2765	2775	2785	2795	2805	2815	
EMCR	YSCKEVLKN-	-----	CNVLENFIVY	NNSGS--NIT	QIKNACVYFS	QLLCEPIKLV	
229E	YSCKEVFKN-	-----	CNVLDDFIVF	NNNGT--NVT	QVKNASVYFS	QLLCRPILKV	
PEDV	YTCKEALKN-	-----	CSIIITDFIVF	NNNGS--NVN	QVKNACVYFS	QMLCKRPVKLV	
TGEV	YSSQEVLSK-	-----	MLLLDDFIVY	SPSGS--ALA	NVRNACVYFS	QLIGKPIKIV	
OC43	FVDYSNLLHS	-----KV	KSVPMHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV	
BoCoV	FVDYSNLLHS	-----KV	KSVPMHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV	
MHV	FVDMNGLLHS	-----KV	KGVPEHVHV	VENEA--DKA	GFLNAAVFYA	QSLYRPMMLV	
AIPV	CFSVTDFLK	AVFLKEALKC	EQISNDGFIV	CNTQSAHALE	EAKNAAIYYA	QYLCKPILIL	
SARS CoV	FVNLONLRAN	-----NT	KGSLPINVIV	FDGKSKCDES	ASKSASVYYS	QLMCQPILL	
						
	2825	2835	2845	2855	2865	2875	
EMCR	NSELLSTLS-	-VDFNGVLHK	AYVDVLCNSF	FKELTANMSM	AECKATLGLT	-----	
229E	DSELLSTLS-	-VDFNGVLHK	AYIDVLRNSF	GKDLNANMSL	AECKRALGLS	-----	
PEDV	DSALLASLS-	-VDFGASLHS	AFVSVLSNSF	GKDLSSCNM	QDCKSTLGLD	D-----	
TGEV	NSDLLEDLS-	-VDFKGALFN	AKKNVKNNSF	NVDVSECKNL	DECYRACNLN	-----	
OC43	DRNLITTANT	GTSVTEMTFD	VYVDTFLSMF	DVDKKSLSNAL	IATAHSSIKQ	GTQIYKVLDT	
BoCoV	DKILITTANT	GTSVTEMTFD	VYVDTFLSMF	DVDKKSLSNAL	IATAHSSIKQ	GTQICKVLDT	
MHV	EKKLITTANT	GLSVSQMTFD	LYVDSLLGVL	DVDRKSLTSE	VNAAHNSLKE	GVQLEQVMDT	
AIPV	DQALYEQLVV	-EPVSKSVID	KVCSILSSII	SVDTAALNYK	AGTLRDALLS	-----	
SARS CoV	DQVLSVDVGD	STEVSVKMF	AYVDTFSATF	SVPMEKALKAL	VATAHSELAK	GVALDGVLS	
						
	2885	2895	2905	2915	2925	2935	
EMCR	-----	-----VSDDDF	VSAVANAHRY	DVLLSDLSFN	NFFISYAKPE	DK-LSVYDIA	
229E	-----	-----ISDHEF	TSAINAHRC	DVLLSDLSFN	NFVSSYAKPE	EK-LSAYDLA	
PEDV	-----	-----VPLDTF	NAAVAEAHRY	DVLLTDMSEF	NFTTSYAKPE	EK-FPVHIDIA	
TGEV	-----	-----VSFSTF	EMAVNNAHRE	GILITDRSFN	NFWPSKVKPG	SSGVSAMDIG	
OC43	FLSCARKSCS	IDSDDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG	
BoCoV	FLSCARKSCS	IDSDDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG	
MHV	FTGCARRKCA	IDSDDVTKSI	TKSIMSAVNA	GVDFTDESCN	NLVPTYVKSD	T--IVAADLG	
AIPV	-----	---ITKDEEA	VDMAIFCHNH	DVDYTGOGFT	NVIPSYGIDT	G-KLTPDRDG	
SARS CoV	FVSAARQG-V	VDTDVDTKDV	IECLKLSHHS	DLEVTDGSCN	NFMLTYNKVE	N--MTPRDLG	
						
	2945	2955	2965	2975	2985	2995	
EMCR	CCMRAGSKVV	NHNVLKESI	PIVGVKDFN	TLSQEGKKYL	VKTKKAGLT	FLLTFNDNQA	
229E	CCMRAGAKVV	NANVLTKDQT	PIVWHAKDFN	SLSAEGRKYI	VKTSKAKGLT	FLLTINENQA	
PEDV	TCMRVGAIV	NHNVLKDSI	PVVWLVDRFI	ALSEETRYKI	IRTTKVKGIT	FMLTFNDCRM	
TGEV	KCMSTDAKIV	NAKVLTORCK	SVVWLSQDFA	ALSSTAQKVL	VKTFVEEYGN	FSLTFNAVGS	
OC43	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QFSSDFQHKL	KKACCKTGLK	LKLTYNKQMA	
BoCoV	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QLSSDFQHKL	KKACCKTGLK	LELTYNKQMA	
MHV	VLIQNSAKHV	QANVAKAANV	ACIWSVDAFN	QLSADLQHRL	RKACSKTGLK	IKLTYNKQEA	
AIPV	FLINADASIA	NLRVKN--AP	PVVWKFSELI	KLSDSCLKYL	ISATVKSQVR	FFITKSGAKQ	
SARS CoV	ACIDCNARHI	NAQVAKSHNV	SLIWNVVDYM	SLSEQLRKQI	RSAAKKNPIP	FRLTCATTRQ	
						
	3005	3015	3025	3035	3045	3055	
EMCR	ITQVP-----	TSIVAKQGAG	-----	FKRTYNFLWY	VCLFVVALFI	GVSFID----	
229E	VTQIP-----	TSIVAKQGAG	D-----	AGHSLTWLWL	LCGLVCLIQF	YLCFFMPY--	
PEDV	HTTIP-----	VCIANKKGAG	LP-----	SFSKVKFFWF	LCLFIVAAFF	ALSFLD----	
TGEV	DDDLPYERFT	ESVSPKSGSG	-----	FFDVITQLKQ	IVILVVFVIF	ICGLCSVYSV	
OC43	NVSVL-----	TPFSLKGGAV	FS-----	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----	
BoCoV	NVSVL-----	TPFSLKGGAV	FS-----	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----	
MHV	NVPII-----	TPFSLKGGAV	FS-----	KVLQWLFVNL	ICFIVLWALM	PTYAVH----	
AIPV	VIACHT--QK	LLVEKKAGGI	VSGTFKCFKS	YFKWLLIFYI	LFTACCSGY	YMEVSKSEVH	
SARS CoV	VVNVI-----	TKISLKGKGI	VS-----	CFKMLMLKATL	LCVLAALVCY	IVMPVHTLS-	
						
	3065	3075	3085	3095	3105	3115	
EMCR	-YTTTIVTSFH	GYDFKYIENG	QLKVFAPLH	CVRNVFDNFM	QWHEAKFGVV	TTNSD-KCPI	
229E	FMVDIVSSFE	GYDFKYIENG	QLKNFEAPLK	CVRNVFENFE	DWHYAKFGFT	PLNKQ-SCPI	
PEDV	-FSTQVSSDS	GYDFKYIESG	QLKTFDNPLS	CVHNVFINFD	QWHDAGFGFT	PVNNP-SCPI	
TGEV	ATQSYIESAE	GYDYMVIKNG	IVQPFDDTIS	CVHNTYKGGF	DWFKAKYGF	PTFGK-SCPI	
OC43	--KSDFLQPV	YASYKVLONG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI	
BoCoV	--KSDFLQPV	YASYKVLONG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI	
MHV	--KSDMQLPL	YASFYKVIDNG	VLRDVTVTD	CFANKFIQFD	QWYESTFGLV	YYRNSRACPV	
AIPV	PMYDVNSTLH	VEGFYKVIDNG	VLRDVTVTD	CFANKFIQFD	QWYESTFGLV	YYRNSRACPV	
SARS CoV	--IHDGYTNE	IIGYKAIQDG	VTRDIISTDD	CFANKHAGFD	AWFSQGGSY	KNDKS--CPV	

	3125 3135 3145 3155 3165 3175
EMCR	VVG---VSEI INVVPVPTN VYLVG-----KTLV FTLQAAFGNT GVCYDFDGV
229E	VVG---VSEI VNTVAGIPSN VYLVG-----KTLI FTLQAAFGNA GVCYDIFGV
PEDV	VVG---VSDE ARTVPGIPAG VYLAG-----KTLV FAINTIFGTS GLCFDASGVA
TGEV	VVGTVFDLEN MRPIPDVPAY VSIVG-----RSLV FAINAAGVNT NMCYDHTGNA
OC43	VVA-VIDQDF GSTVFNVPVK VLRYG-----YHVL HFITHALSAD GVQCYTPHSG
BoCoV	VVA-VVDQDF GSTVFNVPVK VLRYG-----YHVL HFITHALSAD GVQCYTPHSG
MHV	VVA-VIDQDI GYTLENVPVK VLRYG-----FHVH HFITHAFATD SVQCYTPHMQ
AIPV	VTA--VIDGD GTVATGVPGF VSWVMDGVMF IHMTQTERKP WYIPTWFNRE IVGYTQDSII
SARS CoV	VAA-IITREI GFIVPGLPGT VLRAIN-----GDFL HFLPRVFSAV GNICYTPSKL

	3185 3195 3205 3215 3225 3235
EMCR	TS-----DK CIFNSACTRL EGLGGD-NVY CYN-TDLIEG SKPYSILOPN AYYKYDVKN-
229E	TP-----EK CIFTSACTRL EGLGGN-NVY CYN-TALMEG SLPYSSIQAN AYYKYDNGN-
PEDV	DK-----GA CIFNSACTRL SGLGGT-AVY CYK-NGLVEG AKLYSELAPH SYXKMDGN-
TGEV	VSXD-SYFDT CVFNTACTTL TGLGGT-IVY CAK-OGLVEG AKLYSDLMPD YYEHAAGN-
OC43	ISYSNFYASG CVLSSACTMF TMADGSPQPY CYT-EGLMQN ASLYSSLVPH VRYNLANAKG
BoCoV	ISYSNFYASG CVLSSACTMF AMADGSPQPY CYT-DGLMQN ASLYSSLVPH VRYNLANAKG
MHV	IPYDNFYASG CVLSSACTML AHADGTPRPY CYT-EGIMHN ASLYDSLAPH VRYNLANSG
AIPV	TEG-SFYTSI ALFSARCLYL TASNTP-QLY CFNGDNDAPG ALPFGSIIPH RVYFQPNQVR
SARS CoV	IEYSDFATSA CVLAAECTIF KDAMGKVPY CYD-TNLLEG SISYSELAPD TRYVLMDS-

	3245 3255 3265 3275 3285 3295
EMCR	YVRFPEILAR GFGLRTIRTL ATRYCRVGE C RDSHKGVCFG FDKWYVNDGR VD---DGYIC
229E	FIKLPEVIAQ GFGRFRTVRI ATRYCRVGE C VESNAGVCFG FDKWFVNDGR VA---NGYVC
PEDV	AVSLPEIISR GFGRRTIRTK AMTYCRVGQC VQSAEGVCFG ADRFFVYNAE SG---SDFVC
TGEV	MVKLPAIIR- GLGLRFVKTQ ATTYCRVGE C IDSAGKFCFG GONWFVYDNE FG---NGYIC
OC43	FIRFPEVLRE GL-VRIVRTR SMSYCRVGLC EEADEGICFN FNGSWVLNND YYRSLPGTFC
BoCoV	FIRLPEVLRE GL-VRIVRTR SMSYCRVGLC EEADEGICFN FNGSWVLNND YYRSLPGTFC
MHV	YIRFPEVVSE GI-VRIVRTR SMTYCRVGLC EDAEEGVCFN FNSSWVLNND YYRSLPGTFC
AIPV	LIVPQQILHT PY---VVKFV SDSYCRGVC EYTRPGYCVS LNPQWVLEND EYTSKPGVFC
SARS CoV	LIQFPNTYLE GS-VRVVTF DAECYCRHGC ERSEVGICLS TSGRWVLNNE HYRALSGVFC

	3305 3315 3325 3335 3345 3355
EMCR	GDGLIDLNVN VLSIFSSSFS VVAMSGHMLF NFLFAAFITF LCFLVTKFKR VFGDLSYGVF
229E	GTGLWNLVEN ILSMFSSSFS VVAMSGQILL NCALGAFATF CCFLVTKFKR MFGDLSVGVF
PEDV	GTGLFTLLMN VISVFSTKTP VTVLSGQILF NCIIAFVAVA VCFLETKFKR MFGDMSVGVF
TGEV	GNSVLGFFKN VEKLFNSNMS VVATSGAMLV NIIIACLAIA MCVGLKFKR IFGDOCTFLV
OC43	GROVFDLIYQ LFKGLAQPDV FLALTASSIA GAILAVIVVL VFYLLIKLKR AFGDYTSVVF
BoCoV	GROVFDLIYQ LFKGLAQPDV FLALTASSIA GAILAVIVVL VFYLLIKLKR AFGDYTSVVF
MHV	GRNAFDLIHQ VLGGLVRPID FFALTASSVA GAILAVIVVL VFYLLIKLKR AFGDYTSVVF
AIPV	GSTVRELMFS MVSTFTTGVN -PNIYMLAT MFLILVVVVL IFAMVIFQV VFKAYATTVF
SARS CoV	GV DAMNLIAN IFTPLVQPVG ALDVSASVVA GGIIAILVTC AAYTFMKFR VFGYNNHVA

	3365 3375 3385 3395 3405 3415
EMCR	TVVCATLINN ISYVVTON-L FFMILYAILY FVFTRTVR-- YAWIWHIAYI VAYFLLIPWW
229E	TVVAVLLNN VSYIVTON-L VTMIAIYAILY FFATRSLR-- YAWIWCAAYL IAYISFAPWW
PEDV	TVGACTLLNN VSYIVTON-T LGMLGYATLY FLCTKGVR-- YMWIWHLGFEL ISYILTAPWW
TGEV	MIIVTLVNNN VSYFVTQN-T FFMIIYAIVY FYITRKLA-- YPGILDAGFI IAYINMAPWY
OC43	VNVIVWCNVE MMLFVQVYP ILSCVYAICY FYATLYFPSE ISVIMHLQWL VMYGTIMPLW
BoCoV	VNVIVWCNVE MMLFVQVYP TLSCVYAICY FYATLYFPSE ISVIMHLQWL VMYGTIMPLW
MHV	VNVIVWCNVE LMLFVQVYP TLSCLYACFY FYTLYFPSE ISVVMHLQWL VMYGAIMPWW
AIPV	ITMLVWVINA FILCVHSYNS VLAIVLLVLY CYASLVTSRN TVIIMHCWLV FTFLIVPTFW
SARS CoV	ANALLFLMSF TILCLVPAYS FLPGVYSVVF LYLTIFYTND VSFLAHLQWF AMFSPVPPFW

	3425 3435 3445 3455 3465 3475
EMCR	LLTWFSFAAF LELLPNVFKL K----ISTQL FEGDKFIGTF ESAAAGTFVL DMRSYERLIN
229E	LCAWYFLAML TGLLPSLLKL K----VSTNL FEGDKFVGTF ESAAAGTFVI DMRSYEKLAN
PEDV	VLMVYAFSAI FEEMPNLFKL K----VSTQL FEGDKFVGTF ENAAAGTFVL DMHAYERLAN
TGEV	VITAYILVEL YDSLPSLFLK K----VSTNL FEGDKFVGTF ESAAAGTFVI DMRSYETIVN
OC43	FCLLYIAVVV SN--HAFWVF S----YCRKL GTSVRSOGTF EEMALTTFMI TKDSYCKLKN
BoCoV	FCLLYISVVV SN--HAFWVF S----YCRQL GTSVRSOGTF EEMALTTFMI TKDSYCKLKN
MHV	FCIIVVAVVV SN--HALWLF S----YCRKL GTEVRSOGTF EEMSLTTFMI TKESYCKLKN
AIPV	LACCYLGFI YMYTPLFLWC YGTTKNTRKL YDGNFVGNV DLAASKTFVI RGSEFVKLTN
SARS CoV	ITAIYVFCIS LKHCHWFENN Y----LKRKV MFNGVTFTST EEAALCTFLL NKEMYLKLR

	3485 3495 3505 3515 3525 3535
EMCR	T--ISPEKL NYAASYNKYK YSGSASEAD YRCACYAHLA KAMLDYAKDH N-DMLYSPPT
229E	S--ISPEKL SYAASYNRYK YSGNANEAD YRCACYAYLA KAMLDYARDH N-DILYTPPT
PEDV	S--ISTEKL QYASTYNKYK YSGSASEAD YRLACFAHLA KAMMDYASNN N-DLYTTPPT
TGEV	S--TSIARI SYANSFNKYK YTGSMGEAD YRMACYAHLG KALMDYSVNR T-DMLYTPPT
OC43	S--LSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GSDVLYQPPT
BoCoV	S--LSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GSDVLYQPPT
MHV	S--VSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GNDVLYQPPT
AIPV	E--I-GDKFE AYLSAYARLK YSGTGSEQD YLOACRAWLA YALDQYR-NS GVEIVYTPPR
SARS CoV	ETLLPLTQYN RYLAALYNKYK YSGALDTS YREAACCHLA KALNDFS-NS GADVLYQPPT

	3545 3555 3565 3575 3585 3595
EMCR	ISYN-STLQS GLKKMAQPSG CVERCVVRVC YGSTVLNGVM LGDTVTCPRH VIAPS-TTVL
229E	VSYG-STLQA GLRKMAQPSG FVEKCVVRVC YGNTVLNGLW LGDIVYCPRH VIASN-TTSA
PEDV	VSYN-STLQA GLRKMAQPSG VVEKCVVRVC YGNMALNGLW LGDIVMCPRH VIASS-TTST
TGEV	VSVN-STLQS GLRKMAQPSG LVEPCIVRVS YGNVVLNGLW LGDEVICPRH VIASD-TTRV
OC43	ASVSTSLQS GIVKMVNPTS KVEPCVSVT YGNMTLNGLW LDDKVYCPRH VICSSADMTN
BoCoV	ASVSTSLQS GIVKMVNPTS KVEPCVSVT YGNMTLNGLW LDDKVYCPRH VICSSADMTN
MHV	ASVSTSLQS GIVKMVPTS KVEPCVSVT YGNMTLNGLW LDDKVYCPRH VICSSADMTD
AIPV	YSIGVSRQS GFKKLVSPSS AVEKCVSVS YRGNLNGLW LGDTIYCPRH VLG---KFSG
SARS CoV	TSITSAVLQS GFRKMAFPSG KVEGCMVQVT CGTTTLNGLW LDDTVYCPRH VICTAEDMLN

	3605 3615 3625 3635 3645 3655
EMCR	IDYDHAYSTM RLHNFSVSHN G-VFLGVVGV TMHGSVLRIK VSQSNVHTPK HVFKTLKPGA
229E	IDYDHEYSIM RLHNFSIISG T-AFLGVVGA TMHGVTLKIK VSQTNMHTPR HSFRTLKSGE
PEDV	IDYDIALSVL RLHNFSISSG N-VFLGVVSA TMRGALLQIK VNQNNVHTPK YTYRTVRPGE
TGEV	INYNEMSSV RLHNFSVSKN N-VFLGVVSA RYKGVNLVLK VNQNNVHTPE HKFKSIKAGE
OC43	PDYTNLLCRV TSSDFTVLFD R-LSLTVMYS QMRGCMVLVT VTLQNSRTPK YTFGVVVKPGE
BoCoV	PDYTNLLCRV TSSDFTVLFD R-LSLTVMYS QMRGCMVLVT VTLQNSRTPK YTFGVVVKPGE
MHV	PDYSNLLCRV ISSDFCVMSG R-MSLTVMYS QMQGSLVLVT VTLQNPHTPK YSFGVVVKPGE
AIPV	DQWNDVLNLA NNHEFEVTTQ HGVTLNVVSR RLKGAVLILQ TAVANAETPK YKFIKANCGD
SARS CoV	PNYEDLLIRK SNHSFLVQAG N-VQLRVIGH SMQNCLLRK VDTSNPKTPK YKFVRIQPGQ

	3665 3675 3685 3695 3705 3715
EMCR	SFNILACYEG IASGVFGVNL RTNFTIKGSF INGACGSPGY NVRNDGTVEF CYLHQIELGS
229E	GENILACYDG CAQGVFGVNM RTNWTIRGSF INGACGSPGY NLKN-GEVEF VYMHQIELGS
PEDV	SFNILACYDG AAGVYGVNM RSNYTIRGSF INGACGSPGY NINN-GTVEF CYLHQIELGS
TGEV	SFNILACYEG CPGSVYGVNM RSQGTIKGSF IAGTCGSVGY VLEN-GILYF VYMHLELGN
OC43	TFTVLAAYNG KPQGAHFVTM RSSYTIKGSF LCGSCGSVGY VIMG-DCVKF VYMHQIELST
BoCoV	TFTVLAAYNG KPQGAHFVTM RSSYTIKGSF LCGSCGSVGY VIMG-DCVKF VYMHQIELST
MHV	TFTVLAAYNG KSQGAHFVTM RSSYTIKGSF LCGSCGSVGY VLTG-DSVRF VYMHQIELST
AIPV	SFTIACAYGG TVVGLYPVTM RSNGTIRASF LAGACGSVGF NIEK-GVVNF VYMHLELPN
SARS CoV	TFSVLACYNG SPGSVYQCAM RPNHTIKGSF LNCSCGSVGF NIDY-DCVSF CYMHMELPT

	3725 3735 3745 3755 3765 3775
EMCR	GAHVGSDFTG SVYGNFDDQP SLQVESANLM LSDNVVAFLY AALNGCR-- ----WLLRST
229E	GSHVGSFDFG VMYGGFEDQP NLQVESANQM LTVNVVAFLY AALNGCT-- ----WLLKGE
PEDV	GCHVGSDDLQ VMYGGYEDQP TLQVEGASSL FTENVLAFLY AALINGST-- ----WLLSSS
TGEV	GSHVGSNFEG EMYGGYEDQP SMQLEGTVNM SSDNVVAFLY AALINGER-- ----WFTVNT
OC43	GCHTGTDENG DFYGPYKDAQ VVQLLIQDYI QSVNFVAVLY AAILNCCN-- ----WVQSD
BoCoV	GCHTGTDENG DFYGPYKDAQ VVQLPVQDYI QSVNFVAVLY AAILNCCN-- ----WVQSD
MHV	GCHTGTDENG NFYGPYRDAQ VVQLPVQDYI QTVNVVAVLY AAILNRCN-- ----WVQSD
AIPV	ALHTGTDLMG EFYGGYVDEE VAQRVPPDNL VTNNIVAVLY AAIISVRESS FSLPKWLEST
SARS CoV	GVHAGTDLEG KFYGPFVDRQ TAQAAGTDTT ITLNVLAWLY AAVINGDR-- ----WFLNRF

	3785 3795 3805 3815 3825 3835
EMCR	RVNVDFGNEW AMANGYTIVS SV--ECYSIL AAKTGVSV EQ LLASIQHLHE -GFGGKNILG
229E	KLFEVHYNEW AQANGFTAMN GE--DAFSIL AAKTGVSV EQ LLHAIQVLNN -GFGGKQILG
PEDV	RIAVDRFNEW AVHNGMTTVG NT--DCFSIL AAKTGVSV EQ LLASIQSLHK -NFGGKQILG
TGEV	SMSLESYNTH AKTNSFTELS ST--DAFSML AAKTGVSV EQ LLDSIVRLNK -GFGGRTILS
OC43	KCSVEDFNWV ALSNGFSQVK SD--LVIDAL ASMTGVSV EQ LLAAIKRLKN -GFGGRQIMG
BoCoV	KCSVEDFNWV ALSNGFSQVK SD--LVIDAL ASMTGVSV EQ LLAAIKRLKN -GFGGRQIMG
MHV	SCSLEEFNVW AMTNGFSSIK AD--LVLDAL ASMTGVSV EQ LLAAIKRLYS -GFGGKQILG
AIPV	TVSVDDYNKW AGDNGFTPPS TS--TAITKL SAITGVSV EQ LLRTIMVKNS -QWGGDPILG
SARS CoV	TTTLDNFNLV AMKYNYEPLT QDHVDILGPL SAQTGIAVLD MCAALKELLQ NGMNGRTILG

	3845 3855 3865 3875 3885 3895
EMCR	YSSLCDEFTL AEVVQMYGV NLQSGK---V IFGLKTMFLF SVFMTFWAE LFYITNTIWI
229E	YSSLNDEFSI NEVVQMFV NLQSGK---T TSMFKSISLF AGFFVMFWAE LFVYTTTIWV
PEDV	HTSLTDEFTT GEVVQMYGV NLQGGY---V SRACRNVLLV GSFLTFFWSE LVSYTKFFWV
TGEV	YGSCLDEFTT TEVIRQMYGV NLQAGK---V KSFFYPIMTA MTILFAFWLE FMYTPPTIWI
OC43	SCSFEDELTP SDVYQQLAGI KLQSKRTRLF KGTVCWIMAS TFLFSCIITA FVKWTMFMVY
BoCoV	SCSFEDELTP SDVYQQLAGI KLQSKRTRLV KGTVCWIMAS TFLFSCIITA FVKWTMFMVY
MHV	SCVLEDELTP SDVYQQLAGV KLQSKRTRVV KGTCCWILAS TLLFSCIISA FVKWTMFMVY
AIPV	QYNFEDELTP ESVFQIGGV RLQSSFVR-- K--ATSWFWS RCVLACFLFV LCAIVLFTAV
SARS CoV	STILEDELTP FDVVQRCSGV TFQGFKKIIV KGTHHWMLLT FLTSLILIVQ STQWSLFFV

	3905 3915 3925 3935 3945 3955
EMCR	NPVILTPIFC LLLFLSLVLT MFLKHKFLFL QVFLLPVIA TALYNC-VLD YYIVKFLADH
229E	NPGLTFPMI LLVALSLCLT FVVKHKVLF QVFLPSIIV AAIQNC-AWD YHVTKVLAEK
PEDV	NPGYVTPMFA CLSLLSSLLM FTLKHKTLLF QVFLIPALIV TSCINL-AFD VEYVNYLAEH
TGEV	NPTFVSIVLA VTTLISTVVF SGIKHKMLFF MSFVLPVIL VTAHNL-FWD FSYYESLQSI
OC43	TTNMFSITFC ALCVIS-LAM LLVKKHKLVL TMYITP-VLF TLLYNN-YLV VYKHTFRGYV
BoCoV	TTNMFSITFC ALCVIS-LAM LLVKKHKLVL TMYIIP-VLF TLLYNN-YLV VYKHTFRGYV
MHV	TTMHLGVTL C ALCFVS-FAM LLVKKHKLVL TMFIMP-VLC TLFYTN-YLV VYKQSFRLA
AIPV	PLKFYVYAAV ILLMAVLFIS FTVKHMAYM DTELLPTLT VIIGVCAEVP FIYNTLISQV
SARS CoV	YENAFPLPFTL GIMAIAACAM LLVKKHKAFL CLFLLPSLAT VAYFN---MV YMPASVWMRI

	3965	3975	3985	3995	4005	4015
EMCR	FN-YNVSVLQ	MDVQGLVNV	VCLFVVFLH-	--TWRFSEK	ETHWETVYCS	LIAYAYTYFY
229E	FD-YNVSVMQ	MDIQGFVNIF	ICLFVALLH-	--TWRFSEK	CTHWCTYLF	LIAYLYTALY
PEDV	FD-YHVSMLG	FNAQGLVNI	VCFFVTLHG	TYTWRFEN-T	PASSVTVYVA	LLTAAYNIFY
TGEV	VENTNTMFLP	VDMQGVMLTV	FCFIVFVTVS	VRFFTCQSW	FSLAVTTLV	IFNMVKIFGT
OC43	YAWLSYVPS	VEYTYTDEVI	YGMILLVGMV	FVTLRSINHD	LFSFIMFVGR	LISVFSLMYK
BoCoV	YAWLSYVPS	VEYTYTDEVI	YGMILLVGMV	FVTLRSINHD	LFSFIMFVGR	VISVSLWYM
MHV	YAWLSHFVPA	VDYTYMDEV	YGVVLLVAMV	FVTMRSINHD	VFSVMFLVGR	LVSLSMWFY
AIPV	VIFLSQWYDP	VVFDTMVPWM	FLPLVLYTAF	KCVQGCYMS	FNTSLMLLYQ	FVKLGFIYIT
SARS CoV	MTWLELADTS	LSGYRLKDCV	MYASALVLLI	LMTARTVYDD	AARRVWTLMN	VITLVYKVVY

	4025	4035	4045	4055	4065	4075
EMCR	SGD-----	FLSL	LVMFLCAISS	DWYIGAIVFR	LSRLIIFESP	E---SVFSVF
229E	SYD-----	YVSL	LVMLLCAISN	EWYIGAIIFR	ICRFGVAFLP	V---EYVSFY
PEDV	ASD-----	ILSC	AMTLFASVTG	NWFVGAVCYK	VAVYMALRFP	----TFVAIF
TGEV	SDEPWTENQI	---AFCFVNM	LTMIIVSLTTK	DWMVVIASYS	IAYYIVVCVM	P-S-AFVSDF
OC43	GSN-----	LEEEI	LLMLASLFGT	YTWTTLSMA	VAKVIKWA	VNV-LYFTDI
BoCoV	GSN-----	LEEEI	LLMLASLFGT	YTWTTLSMA	VAKVIKWA	VNV-LYFTDI
MHV	GAN-----	LEEEV	LLFLTSLSFGT	YTWTTLSLA	TAKVIKWA	VNV-LYFTDV
AIPV	SSNTLTAYTE	GNWELFFELV	HTTVLANVSS	NSLIGLFVFK	CAKWMLYYCN	-----ATYL
SARS CoV	GNALD-----	QAISM	WALVISVTSN	YSGVVTTIME	LARAIVFVCV	EYYPFLFITG

	4085	4095	4105	4115	4125	4135
EMCR	GDVRLTLVVY	LICGVLCTY	WGILYWFNRF	FKCTMGVYDF	KVSAAEFKYM	VANGLHAPYG
229E	DGVKTVLLFY	MLLGEVSCMY	YGLLYWINRF	CKCTLGVDYF	CVSPAEEFKYM	VANGLNAPNG
PEDV	GDIKSVMFY	LVLGYTFCCF	YGILYWFNRF	FKSVGVYDY	TVSAAEFKYM	VANGLRAPTG
TGEV	GFMKCSIVY	MAGCYLFCCY	YGILYWFNRF	TCMTCGVYQF	TVSAAELKYM	TANNLSAPKN
OC43	PQIKIVLLCY	LFIGYIISCY	WGLFSLMNSL	FRMPLGVYNY	KISVQELRYM	NANGLRPPKN
BoCoV	PQIKIVLVY	LFIGYIISCY	WGLFSLMNSL	FRMPLGVYNY	KISVQELRYM	NANGLRPPKN
MHV	PQVKLVLLSY	LCIGYVCCCY	WGLVSLLSNI	FRMPLGVYNY	KISVQELRYM	NANGLRPPRN
AIPV	NNYVLMAMV	NCIGWLCTCY	FGLYVWVNVK	FGLTLGKYNF	KVSDQVRYM	CLHKNPPKT
SARS CoV	NTLQCIMLVY	CFLGYCCCCY	FGLFCLLNRY	FRLTLGVYDY	LVSTQEFYRM	NSQGLLPPKS

	4145	4155	4165	4175	4185	4195
EMCR	PFDALWLSFK	LLGIGGDRCI	KISTVQSKLT	DLKCTNVVLL	GCLSSMNIAA	NSSEWAYCVD
229E	PFDALFLSFK	LMGIGGPRTI	KVSTVQSKLT	DLKCTNVVLM	GILSNMNIAS	NSKEWAYCVE
PEDV	TLDLSLLSAK	LIGIGGERNI	KISSVQSKLT	DIKCSNVVLL	GCLSSMNVSA	NSTEWAYCVD
TGEV	AYDAMILSAK	LIGVGGKRN	KISTVQSKLT	EMKCTNVVLL	GLLSKMHVES	NSKEWNYCVG
OC43	SFEALMLNFK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	NSKLWHYCST
BoCoV	SFEALMLNFK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	NSKLWHYCST
MHV	SFEALVLNFK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	SSKLWHYCST
AIPV	VWEVFSTNIL	IQGIGGDRVL	PIATVQAKLS	DVKCTTVVLM	QLLTKLNVEA	NSKMHVYLVE
SARS CoV	SIDAFKLNK	LLGIGGKPCI	KVATVQSKMS	DVKCTSVVLL	SVLQQLRVES	SSKLWQAQCVQ

	4205	4215	4225	4235	4245	4255
EMCR	LHNKINLCDD	PEKAQGMLLA	LLAFFLSKHS	DFG-----L	DGLIDSFYDN	SSTLQSVASS
229E	MHNKINLCDD	PETAQELLLA	LLAFFLSKHS	DFG-----L	GDLVDSYFEN	DSILQSVASS
PEDV	LHNKINLCND	PEKAQEMLLA	LLAFFLSKNS	AFG-----L	DDLLESYFND	NSMLQSVAST
TGEV	LHNEINLCDD	PEIVLEKLLA	LLAFFLSKHN	TCD-----L	SELIESYFEN	TTILQSVASA
OC43	LHNEILATSD	LSVAFERLAQ	LLIVLFANPA	AVDSKCLTSI	EEVCDYAKD	NTVLQALQSE
BoCoV	LHNEILATSD	LGVAFERLAQ	LLIVLFANPA	AVDSKCLTSI	EEVCDYAKD	NTVLQALQSE
MHV	LHNEILATSD	LSVAFERLAQ	LLVVLFFANPA	AVDSKCLASI	EEVSDDYVRD	STVLQALQSE
AIPV	LHNKILASDD	VGECMDNLLG	MLITLFCIDS	TID-----L	SEYCDILKR	STVLQSVTQE
SARS CoV	LHNDILLAKD	TTEAFKRMVS	LLSVLLSMQG	AVD-----I	NRLCEEMLDN	RATLQAIASE

	4265	4275	4285	4295	4305	4315
EMCR	FVSMPSYIAY	ENARQAYEDA	IANGSS----	SQLIKQLKRA	MNIASEFDR	EISVQKKINR
229E	FVGMPSFVAY	ETARQYENA	VANGSS----	PQIIKQLKKA	MNVAKAEFDR	ESSVQKKINR
PEDV	YVGLPSYVIY	ENARQYEDA	VNNGSP----	PQLVKQLRHA	MNVAKSEFDR	EASTQKRLDR
TGEV	YAALPSWIAL	EKARADLEEA	KKNDSV----	PQILKQLTKA	FNIASDFER	EASVQKKLDK
OC43	FVNMAFVEY	EVAKKNLDEA	RFSGSAN----	QQQLKQLEKA	CNIASAYER	DRAVAKLER
BoCoV	FVNMAFVEY	EVAKKNLDEA	CSSGSAN----	QQQLKQLEKA	CNIASAYER	DRAVAKLER
MHV	FVNMAFVEY	ELAKKNLDEA	KASGSAN----	QQIKQLEKA	CNIASAYER	DRAVAKLER
AIPV	FSHIPSYAEY	ERAKNLYEKV	LVDSKNGGVT	QOELAAARKA	ANIASKVFDR	DLAVQKKLDS
SARS CoV	FSSLPSYAA	ATAQAYEQA	VANGDS----	EVVLKLLKKS	LNVAKSEFDR	DAAMQKLEK

	4325	4335	4345	4355	4365	4375
EMCR	MAEQAAQMY	KEARSVNRKS	KVISAMHSLL	FGMLRRLDMS	SVETVLNLAR	DGVVPLSVIP
229E	MAEQAAAQMY	KEARAVNRKS	KVISAMHSLL	FGMLRRLDMS	SVDTILNMAR	NGVVPLSVIP
PEDV	MAEQAAAQMY	KEARAVNRKS	KVISAMHSLL	FGMLRRLDMS	SVDTILNLAK	DGVVPLSVIP
TGEV	MAEQAAASMY	KEARAVDRKS	KVISAMHSLL	FGMLKRLDMS	SVNTIIDQAR	NGVLPLSIIP
OC43	MADLALTMY	KEARINDKKS	KVVSALQTM	FSMVRKLONQ	ALNSILDNAV	KGCVPPLNAIP
BoCoV	MADLALTMY	KEARINDKKS	KVVSALQTM	FSMVRKLONQ	ALNSILDNAV	KGCVPPLNAIP
MHV	MADLALTMY	KEARINDKKS	KVVSALQTM	FSMIRKLONQ	ALNSILDNAV	KGCVPPLNAIP
AIPV	MAERAMTMY	KEARVTDORRA	KLVSSLHALL	FSMLKKIOSE	KLVNLFDOAS	SGVVPLATVP
SARS CoV	MADQAMTMY	QARSEDKRA	KVTSAMQTM	FTMLRKLONQ	ALNNIINNAR	DGCVPPLNIIP

	4385	4395	4405	4415	4425	4435
EMCR	ATSASKLTIV	SPDLESYSKI	VCDGSHVYAG	VVWTLNDVKD	NOGRPVHVKE	ITR-----EN
229E	ATSAARLVVV	VPDHSFVKM	MVDGSHVYAG	VVWTLQEVKD	NOGKNVHLKD	VTK-----EN
PEDV	AVSATKLNIV	TSDIDSYNRI	QREGCVHYAG	TIWNIIDIKD	NDGKVVHVKE	VTA-----QN
TGEV	AASATRLVVI	TPSLEVFSKI	RQENNVHYAG	AIWTIVEVKD	ANGSHVHLKE	VTA-----AN
OC43	SLAANTLNII	VDPKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLNE	IS-----
BoCoV	SLAANTLTII	VDPKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLHE	IS-----
MHV	SLTSNTLTII	VDPKQVFDQV	VDNVVVTYAG	NVWHIQSIQD	ADGAVKQLNE	ID-----
AIPV	IVCSNKLTIV	IPDPETWVKC	VEGVHVTYST	VVWNIDTVID	ADGTELHPTS	TGSGLTTCIS
SARS CoV	LTAAKLMVV	VPDYGTYNK	CDGNTFTYAS	ALWEIQQVVD	ADSKIVQLSE	INM-----DN

	4445	4455	4465	4475	4485	4495
EMCR	VETLTWPLIL	NCER-----	VVKLQNNIEM	PGKLRQKFMK	AEG--DGGVL	GDGNALYNTE
229E	QEILVWPLIL	TCER-----	VVKLQNNIEM	PGKMKVKATK	GEG--DGGIT	SEGNALYNNE
PEDV	AESLSWPLVL	GCER-----	IVKLQNNIEM	PGKLRQKSIK	AEG--DG-IV	GEGKALYNNE
TGEV	ELNLTWPLSI	TCER-----	TTKLQNNIEM	PGKLRKRAVR	ASATLDGEAF	GSGLKALMASE
OC43	-DDCNWPLVI	IANRY-NEVS	ATVLQNNIEM	PAKLKIQVNV	SGP--DOTCN	TPTQCYNNNS
BoCoV	-DDCNWPLVI	IANRH-NEVS	ATVLQNNIEM	PAKLKTQVNV	SGP--DOTCN	TPTQCYNNNS
MHV	-VNITWPLVI	AANRH-NEVS	SVVLQNNIEM	PQKLRTQVNV	SGS--DMNCN	TPTQCYNNNT
AIPV	GANTAWPLKV	NLTRNGHNV	DVVLQNNIEM	PHGVKTACV	AGVD-QAHCS	VESKCYNNNI
SARS CoV	SPNLAWPLIV	TALRA-N--S	AVKLQNNELS	PVALRQMSCA	AGTTQTACTD	DNALAYNNNS

	4505	4515	4525	4535	4545	4555
EMCR	GGKTFMYAYI	SNKADLKFKV	WEY-EGG-CN	TIELDSPCRF	MVETPNGPQV	KYLYFVKNLN
229E	GGRAFMYAYV	TTKPGMKYVK	WEH-DSG-VV	TVELEPPCRF	VIDTPTGPQI	KYLYFVKNLN
PEDV	GGRTFMYAFI	SDKPDLRVVK	WEF-DGG-CN	TIELEPPKRF	LVDSPNGAQI	KYLYFVRNLN
TGEV	SGKSFMYAFI	ASDNNLKYYK	WES-NND-II	PIELEAPLRF	YVDGANGPEV	KYLYFVKNLN
OC43	NNGKIVVAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDAKGLKI	KYLYFVKGCN
BoCoV	YNGKIVVAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDVKGLKI	KYLYFVKGCN
MHV	GMGKIVVAIL	SDCDGLKYTK	IVKEDGN-CV	VLELDPPCKF	SVQDVKGLKI	KYLYFVKGCN
AIPV	SGNSVVAAIT	SSNPNLKVAS	FLNEAGN-QI	YVDLDPPCKF	GMKVGKVEV	VYLYFIKNTN
SARS CoV	KGGRFVLALL	SDHQDLKWAR	FPSDGTGTI	YTELEPPCRF	VTDTPKGPKV	KYLYFIKGLN

	4565	4575	4585	4595	4605	4615
EMCR	TLRRGAVLGF	IGATVRLQAG	-KQTELVANS	GLLTACAFSV	DPATTYLEAV	KHGAKPVNSC
229E	NLRRGAVLGY	IGATVRLQAG	-KQTEFVSNS	HLLTHCSFAV	DPAAAYLDAV	KQGAQPVGNC
PEDV	TLRRGAVLGY	IGATVRLQAG	-KQTEQAINS	SLTLCAFAV	DPAKTYIDAV	RSCHKPVGNC
TGEV	TLRRGAVLGY	IGATVRLQAG	-KPTEHPSNS	SLTLCAFAV	DPAKAYVDVAV	KRGMPVNNC
OC43	TLARGWVVG	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGGTPIANC
BoCoV	TLARGWVVG	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGGTPIANC
MHV	TLARGWVVG	LSSTVRLQAG	-TATEYASNS	AIRSLCAFSV	DPKKTLYLDYI	QGGGAPVTNC
AIPV	SIVRGMYLGA	ISNVVLQSK	GHETEEDAV	GILSLCSFAV	DPADTYCKYV	AAGNQPLGNC
SARS CoV	NLNRGMVLGS	LAATVRLQAG	-NATEVPANS	TVLSFCFAV	DPAKAYKDYL	ASGGQPIITNC

	4625	4635	4645	4655	4665	4675
EMCR	IKMLNSGAGN	GQAITSVDA	NTNQDSYGGA	SICLYCRAHV	PHP---SMD	GYCKFKGKCV
229E	VKMLTNGSGS	GQAITCTIDS	NTTQDTSYGGA	SVCICYCRAHV	AHP---TMD	GFCQYKGGKV
PEDV	VKMLANGSGN	GQAVTNGVEA	STNQDSYGGA	SVCICYCRAHV	EHP---SMD	GFCRLKGGKV
TGEV	VKMLNSGAGN	GMAVTNGVEA	NTQDTSYGGA	SVCICYCRHV	EHP---AID	GLCRYKGGKV
OC43	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP---DVD	GLCKLRGKFV
BoCoV	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP---DVD	GLCKLRGKFV
MHV	VKMLCDHAGT	GMAITIKPEA	TTNQDSYGGA	SVCICYCRSRV	EHP---DVD	GLCKLRGKFV
AIPV	VKMLTVHNSG	GFAITSKPSP	TPDQDSYGGA	SVCICYCRAHI	AHPGVSNGLD	GRCQFKGSEF
SARS CoV	VKMLCTHTGT	GQAITVTPEA	NMDQESFPGA	SCCLYCRCHI	DHP---NPK	GFCDLKGGKV

	4685	4695	4705	4715	4725	4735
EMCR	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CACDRTTIQS	-----	-VDISYLNQ
229E	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CTCDRTAIQS	-----	-FDNSYLNQ
PEDV	QVPLGTQ-DP	IRFVLENDVC	NVCGCWLNSG	CTCDRSIMQS	-----	-T-----
TGEV	QIPTGTQ-DP	IRFCLENNVC	NVCGCWLNSG	CMCDRTSMQS	F-----	TVDSYLNQ
OC43	QVPVGIK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVSTDTTV	Q-----	SKDT-----
BoCoV	QVPVGIK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVSTDTTV	Q-----	SKDTNLFNGF
MHV	QVPLGIK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVGTGSQF	Q-----	SKDTNLFNGF
AIPV	QIPTTEK-DP	VGFCRLNKVC	TVCQCWIGYG	CQCDSLRQPK	SSVQSVAGAS	DFDKNYLNGY
SARS CoV	QIPTTCANDP	VGFTLRNTVC	TVCGMWKGYG	CSCDQLREPL	M-----	QSADASTFLN

	4745
EMCR	GVLVQLD
229E	GALVPLD
PEDV	-----
TGEV	GVLVQLD
OC43	-----
BoCoV	GVRV---
MHV	GVQV---
AIPV	GVAVRLG
SARS CoV	GFAV---

C. Putative orf 1b

	5	15	25	35	45	55
EMCR	-----	-----	RARGSSAARL	EPCN-GTDID	KCVRAFDIYN	KNVSFLGKCL
229E	-----	-----	-----	EPCN-GTDID	YCVRAFDVYN	KDASFIGKNL
PEDV	-----	-----	YGLFK RVRGSSAARL	EPCN-GTDTQ	HVYRAFDIYN	KDVACLKGFL
TGEV	-----	-----	-----	EPCN-GTDPD	HVSRAFDIYN	KDVACIGKFL
BoCoV	-----	-----	FFKR VRGTSVDARL	VPCASGLSTD	VQLRAFDICN	ASVAGIGLHL
OC43	-----	-----	FFKR VRGTSVDARL	VPCASGLSTD	VQLRAFDIYN	ASVAGIGLHL
MHV	LFLCRHRLPV	SVKRHELFKR	VRGTSVNARL	VPCASGLDTD	VQLRAFDICN	ANRAGIGLYY
AIPV	-----	-----	-----	-----	-----	MFQNL
SARS CoV	-----	-----	-----	TPCGTGTSTD	VVYRAFDIYN	EKVAGFAKFL
	65	75	85	95	105	115
EMCR	KMNCVRFKNA	-----DL	KDGYFVIKRC	TKSVMHEQES	MYNLLNFSGA	LAEHDFFTWK
229E	KSNCVRFKNV	-----DK	DDAFYIVKRC	IKSVMDEHQS	MYNLLKGCNA	VAKHDFFTWH
PEDV	KVNCVRLKNL	-----DK	HDAFYVVKRC	TKSVMHEQES	IYSRLEKCGA	IAEHDFFTWK
TGEV	KTNCSTRFNL	-----DK	HDAFYIVKRC	TKTVMDEHQS	CYNDLKDSCA	VAEHDFFTYK
BoCoV	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKDCRF	VAEHDFFTFD
OC43	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKDCRF	VAEHDFFTFD
MHV	KVNCCRFQRA	--DEEG--NT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV	VAEHDFFTFD
AIPV	KRNCARFQEL	RTEDGNLEY	LDSYFVVKQT	TPSNYEHEKS	CYEDLKS-EV	TADHDFVFN
SARS CoV	KTNCCRFQEK	--DEEG--NL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA	VAVHDFFKFR
	125	135	145	155	165	175
EMCR	DGRVIYGNVS	RHNLTRYTMM	DLVYAMRNF	EQNCQVLKEV	LVLTGCCDNS	----YFDSKG
229E	EGRTIYGNVS	RQDLTKYTMM	DLVYAMRNF	EKDCQVFKKEI	LVLTGCCSTD	----YFEMKN
PEDV	DGRAIYGNVC	RKDLTKYTMM	DLVYAMRNF	ENNCQVLKSI	LIKVGACEES	----YFNKVV
TGEV	EGRCFEGNVA	RHNLTRYTMM	DLVYAMRNF	EKNCQVLKEI	LVTVGACTEE	----FFENKD
BoCoV	VEGSRVPHIV	RKDLTKYTMM	DLVYAMRNF	RNDCMLLCDI	LSIYAGCEQS	----YFTKKD
OC43	VEGSRVPHIV	RKDLTKYTMM	DLVYAMRNF	RNDCMLLCDI	LSIYAGCEQS	----YFTKKD
MHV	VEGSRVPHIV	RKDLTKYTMM	DLVYAMRNF	RNDCMLLCDI	LLTYAECDES	----YFQKDD
AIPV	KN---IYNIS	RQDLTKYTMM	DLVYAMRNF	PKDCQVLKEI	LVTYGCIEDY	HPKWFEENKD
SARS CoV	VDGDMVPHIS	RQDLTKYTMM	DLVYAMRNF	EGNCQVLKEI	LVTYGCIEDY	----YFNKDD
	185	195	205	215	225	235
EMCR	WYDPVENEDI	HRVYASLGKI	VARAMLKCV	LCDAVMAKGV	VGVLTLDNQD	LNGNFYDFGD
229E	WFDPIENEDI	HRVYASLGKI	VARAMLKCV	FCDEMVLKGV	VGVLTLDNQD	LNGNFYDFGD
PEDV	WFDPIENEDI	HRVYASLGKI	VARAMLKCV	FCDEMVLKGV	VGVLTLDNQD	LNGNFYDFGD
TGEV	WFDPIENEDI	HEVYAKLGPI	VARAMLKCV	FCDAIVEKGY	IGVITLDNQD	LNGNFYDFGD
BoCoV	WYDFVENPDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWDYDFGD
OC43	WYDFVENPDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWDYDFGD
MHV	WYDFVENSDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LYGQWYDFGD
AIPV	WYDFVENSDI	YVMLAKMGPI	VRALLNAIE	FGNLMVEKGY	VGVLTLDNQD	LNGKWDYDFGD
SARS CoV	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAVMAKGV	VGVLTLDNQD	LNGKWDYDFGD
	245	255	265	275	285	295
EMCR	FVLSLPMNGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSXI	FGSDFKTFDL	LKYDFTEHKE
229E	FVLCPPGMI	PCCTSYYSYM	MPVGMGTNCL	ASECFVKSXI	FGQDFKTFDL	LKYDFTEHKE
PEDV	FTCSIKMGV	PCCTSYYSYM	MPVGMGTNCL	ASECFVKSXI	FGEDFKSYDL	LEYDFTEHKE
TGEV	FVKTAPEGFC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKSXI	YGSDFKQYDL	LAYDFTEHKE
BoCoV	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTDYKL
OC43	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTDYKL
MHV	FVKTVPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELEFINGTY	R-----EFDL	VQYDFTDYKL
AIPV	FQKTAPEGAGV	PVFDYYSYM	MPILMTDAL	APERFYEDYV	HKG-YKSVDL	LKYDYTEERQ
SARS CoV	FVQVAPGCGV	PVDSYYSYL	MPILMTDAL	AAESHMDADL	AKP-LIKWDL	LKYDYTEERL
	305	315	325	335	345	355
EMCR	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHIC	ANFNLTFLATT	IPGTAFGPLC	RKVFDIGVPL
229E	NLFNKYFKYW	GQDYHPDCVD	CHDEMCIHIC	SNFNLTFLATT	IPNTAFGPLC	RKVFDIGVPL
PEDV	NLFNKYFKYW	GQDYHPDCVD	CHDEMCIHIC	SNFNLTFLATT	IPNTAFGPLC	RKVFDIGVPL
TGEV	NLFNKYFKYW	DRYHPNCSD	CTSDECIHIC	ANFNLTFLATT	IPMTAFGPLV	RKVFDIGVPL
BoCoV	NLFNKYFKHW	SMFYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
OC43	NLFNKYFKHW	SMFYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
MHV	NLFNKYFKYW	SMFYHPNTCE	CEDDRCIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
AIPV	NLFNKYFKYW	QDYHPNCSD	CQDDRCIHC	ANFNILFSTL	IPQTSFGNLC	RKVFDIGVPP
SARS CoV	NLFNKYFKYW	QDYHPNCSD	CLDDRCIHC	ANFNILFSTV	FPPTSFGPLV	RKVFDIGVPP

	365	375	385	395	405	415
EMCR	VTTAGYHFKQ	LGLVWNKDVN	THSVRLTITE	LLQFVTDPSL	IIASSPALVD	QRTICFSVAA
229E	VATAGYHFKQ	LGLVWNKDVN	THSTRLTITE	LLQFVTDPTL	IVASSPALVD	KRTVCFSVAA
PEDV	VTTAGYHFKQ	LGIWVNNDLN	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD	QRTVCFSVAA
TGEV	VVTAGYHFKQ	LGIWVNNLKV	LDTMKLSMTD	LLRFVTDPTL	LVASSPALLO	QRTVCFSIAA
BoCoV	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
OC43	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
MHV	VVSIGYHYKE	LGVVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALLD	LRTCCFSVAA
AIPV	IATCGYHSKE	LGVIMNQDNT	MSFSKMGLSQ	LMQFVGDPAL	LVGTSNNLVD	LRTSCFSVCA
SARS CoV	VVSTGYHFRE	LGVVHNQDVN	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD	KRTTCFSVAA

	425	435	445	455	465	475
EMCR	LSTGLTNQVV	KPGHNEEFY	NFLRLRGFFD	EGSELTLLKH	FFAQNGDAAV	KDFDFYRYNK
229E	LSTGLTSQTV	KPGHENKEFY	DFLRSQGFFD	EGSELTLLKH	FFTQKGDAAI	KDFDYRYRNR
PEDV	LGTGMTNQT	KPGHENKEFY	DFLLEQGFSS	EGSELTLLKH	FFAQKVDAAV	KDFDYRYRNR
TGEV	LSTGITYQTV	KPGHFNKDFY	DFITERGFFE	EGSELTLLKH	FFAQGGGAAM	TDFNYRYRNR
BoCoV	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
OC43	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
MHV	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
AIPV	LTSGITHQTV	KPGHFNKDFY	DFAEKAGMFK	EGSSIPLKH	FYPQTGNAAI	NDYDYRYRNR
SARS CoV	LTNNVAFQTV	KPGHFNKDFY	DFAVSKGFEK	EGSSVELKH	FFAQDGNAAI	SDYDYRYNL

	485	495	505	515	525	535
EMCR	PTILDICQAR	VTYKIVSRYF	DIYEGGCIKA	CEVVVTNLNK	SAGWPLNFKG	KASLYYESIS
229E	PTMLDIGQAR	VAYQVAARYF	DCYEGGCITS	REVVVTNLNK	SAGWPLNFKG	KAGLYYESIS
PEDV	PTVLDICQAR	VYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNFKG	KAGLYYESLS
TGEV	VTVLDICQAR	FVYKIVGKYF	ECYDGGCINA	REVVVTNYDK	SAGYPLNFKG	KARLYYESLS
BoCoV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
OC43	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
MHV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
AIPV	PTMEDICQLL	FCLEVTSKYF	ECYEGGCIKA	SQVIVNNLDK	SAGYPFNKFG	KARLYYE-MS
SARS CoV	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGFPFNKFG	KARLYYDSMS

	545	555	565	575	585	595
EMCR	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHQKHLKSIV
229E	YEEQDAIFSL	TKRNILPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ	FHQKCLKSIV
PEDV	YEEQDELYAY	TKRNILPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHQKHLKSIV
TGEV	YEEQDALFAL	TKRNVLPMT	QMNLYKAISG	KARARTVGGV	SLLSTMTTRQ	YHQKHLKSIA
BoCoV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
OC43	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
MHV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
AIPV	LEEQDQLFEI	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTNRQ	FHQKILKSIV
SARS CoV	YEDQDALFAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SICSTMTNRQ	FHQKILKSIA

	605	615	625	635	645	655
EMCR	NTRNATVVIG	TKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI	RMISAMVLGS
229E	ATRNATVVIG	TKFYGGWNN	MLKNLMADVO	DPKLMGWDP	KCDRALPNMI	RMISAMVLGS
PEDV	NTRGASVVIG	TKFYGGWNN	MLKNLIDGVE	NPCLMGWDYP	KCDRALPNMI	RMISAMVLGS
TGEV	ATRNATVVIG	TKFYGGWNN	MLKNLMRDVO	NGCLMGWDYP	KCDRALPNMI	RMASAMVLGS
BoCoV	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	NPVLMGWDP	KCDRALPNIL	RIVSSVLAR
OC43	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	NPVLMGWDP	KCDRALPNIL	RIVSSVLAR
MHV	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	SPVLMGWDP	KCDRALPNIL	RIISSLVLAR
AIPV	NTRNASVVIG	TKFYGGWNN	MLRNLIQGVE	DPILMGWDYP	KCDRALPNLL	RIASLVLAR
SARS CoV	ATRGATVVIG	TSKFYGGWNN	MLKTVYSDE	TPHLMGWDP	KCDRALPNML	RIASLVLAR

	665	675	685	695	705	715
EMCR	KHVNCCCTVD	RFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA	NSIFNIFQAV
229E	KHVTCTTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
PEDV	KHTTCCSSTD	RFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
TGEV	KHVGCCCTHND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTATAYA	NSAFNIFQAV
BoCoV	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
OC43	KHETCCSSTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
MHV	KHOSCCSSTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
AIPV	KHTNCCSWE	RIYRLYNECA	QVLSETVLAT	GGIYVKPGGT	SSGDATTAYA	NSVFNIIQAT
SARS CoV	KHNTCCNLSH	RFYRLANECA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA	NSVFNICQAV

	725	735	745	755	765	775
EMCR	SSINRLLSV	PSDCNNVNV	RDLQRLYDN	CYRLTSVEES	FIDDIYGYLR	KHFSMMILSD
229E	SSINCVLSV	NSSNCNNFNV	KKLQRLYDN	CYRNSNVEDS	FVDDFYGYLQ	KHFSMMILSD
PEDV	SANVNKLLSV	DSNVCHNLEV	KQLQRLYEC	CYRSTIVDDQ	FVVEYGYLR	KHFSMMILSD
TGEV	SANVNKLLGV	DSNACNVTV	KSIQRLYDN	CYRSSSIDEE	FVVEYFSYLR	KHFSMMILSD
BoCoV	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDMVDS	FVTEYEFNL	KHFSMMILSD
OC43	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDKVDST	FVTEYEFNL	KHFSMMILSD
MHV	SANVCALMAC	NGHKIEDLSI	RELQRLYSH	VYRADHVDPA	FVNEYYEFLN	KHFSMMILSD
AIPV	SANVARLLSV	ITRDIVYDNI	KSLQYELYQQ	VYRRVNDPDA	FVEKFYSYLC	KNFSLMILSD
SARS CoV	TANVNALLST	DGNKIADKYV	RNLQRLYEC	LYRNRDVEHE	FVDEFYAYLR	KHFSMMILSD

	785 795 805 815 825 835
EMCR	DGVVCYNKDY AELGYIADIS AFKATLYYQN NVFMSTSKCW VEEDLTRKGP EFCSQHTMQI
229E	DSVVCYNKTY AGLGYIADIS AFKATLYYQN GVFMSTAKCW TEEDLSIGPH EFCSQHTMQI
PEDV	DGVVCYNNDY ASLGYVADLN AFKAVLYYQN NVFMSASKCW IEPDINKGPH EFCSQHTMQI
TGEV	DGVVCYNKDY ADLGYVADIN AFKATLYYQN NVFMSTSKCW VEPDLSVGP EFCSQHTLQI
BoCoV	DGVVCYNNDY ASKGYIANIS AFQOVLYYQN NVFMSESKCW VENDINNGPH EFCSQHTMLV
OC43	DGVVCYNNDY ASKGYIANIS AFQOVLYYQN NVFMSESKCW VEHDINNGPH EFCSQHTMLV
MHV	DGVVCYNSEF ASKGYIANIS AFQOVLYYQN NVFMSEAKCW VETDIEKGP EFCSQHTMLV
AIPV	DGVVCYNNTL AKQGLVADIS GFREVLYYQN NVFMADSKCW VEPDLERKGP EFCSQHTMLV
SARS CoV	DAVVCYNSNY AAQGLVASIK NFKAVLYYQN NVFMSEAKCW TETDLTKGP EFCSQHTMLV

	845 855 865 875 885 895
EMCR	VDKDGTYYLP YPDPSRILSA GVFVDDVVKT DAVVLLXRYV SLAIDAYPLS KHPNSEYRKV
229E	VDENGKYYLP YPDPSRIISA GVFVDDITKT DAVILLERYV SLAIDAYPLS KHPKPEYRKV
PEDV	VDKEGTYYLP YPDPSRILSA GVFVDDVVKT DAVVLLERYV SLAIDAYPLS KHENPEYKRV
TGEV	VGPDDGYLP YPDPSRILSA GVFVDDIVKT DNVIMLERYV SLAIDAYPLT KHPKPAYQKV
BoCoV	KMDGDDVYLP YPVPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENEYQKV
OC43	KMDGDDVYLP YPNPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENEYQKV
MHV	KMDGDEVYLP YPDPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENPEYQNV
AIPV	EVDGEPYLP YPDPSRILGA CVFVDDVDKT EPVAVMERYI ALAIDAYPLV HHENEYKRV
SARS CoV	RQGGDDVYLP YPDPSRILGA GCFVDDIVKT DGTLMIERFV SLAIDAYPLT KHPNQEYADV

	905 915 925 935 945 955
EMCR	FYVLLDWVKH LNKNLNEGVL ESFSVTLNLDN QEDKFWCEDF YASMYENSTI LQAAGLCVVC
229E	FYVLLDWVKH LNKTLNEGVL ESFSVTLNLDN HESKFWDESF YASMYEKSTV LQAAGLCVVC
PEDV	FYVLLDWVKH LYKTLNAGVL ESFSVTLNLDN STAKFWDESF YANMYEKSAV LQAGLCVVC
TGEV	FYTLLDWVKH LQKLNAGVL DSFSVTMLLE QDKFWSEEF YASLYEKSTV LQAAGLCVVC
BoCoV	FRVYLEYIKK LYNELGNQIL DSYSVILSTC DGQKFTDESF YKNMYLRSV MQSVGACVVC
OC43	FRVLYLAYIKK LYNDLGNQIL DSYSVILSTC DGQKFTDESF YKNMYLRSV MQSVGACVVC
MHV	FRVYLEYIKK LYNDLGNQIL DSYSVILSTC DGQKFTDETF YKNMYLRSV MQSVGACVVC
AIPV	FFVLLAYIRK LYQELSQNML MDYSFVMDID KGSKEWEQEF YENMYRAPPT LQSCGCVVC
SARS CoV	FHLYLQYIRK LHDELTHGML DMYSVMLTND NTSRYWEPEF YEAMYTPHTV LQAVGACVLC

	965 975 985 995 1005 1015
EMCR	GSQTVLRCDG CLRKEMLCCK CAYDHVFGTD HKEFLAITPY VCNASGCGVS DVKKLYLGGL
229E	GSQTVLRCDG CLRRPMLCTK CAYDHVFGTD HKEFLAITPY VCNATSGCNV DVTKLYLGGL
PEDV	GSQTVLRCDG CLRRPMLCTK CAYDHVIGTT HKEFLAITPY VCCASDCGNV DVTKLYLGGL
TGEV	GSQTVLRCDG CLRRPLLCTK CAYDHVMGK HKEFIMSITPY VCSFNGCNV DVTKLYLGGL
BoCoV	SSQTSLRCSG CIRKPLLCCK CCYDHVMATD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
OC43	SSQTSLRCSG CIRKPLLCCK CCYDHVMATD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
MHV	SSQTSLRCSG CIRKPLLCCK CAYDHVMSTD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
AIPV	NSQTLRCSG CIRKPLLCCK CCYDHVMHTD HKNVLSINPY ICSQLGCGEA DVTKLYLGGM
SARS CoV	NSQTSLRCSG CIRKPLLCCK CCYDHVISTS HKLVLSVNPY VCNAPGCDVT DVTKLYLGGM

	1025 1035 1045 1055 1065 1075
EMCR	NYCYCTNHKPK LSFPPLCSAGN IFGLYKNSAT GSLOVEVFNR LATSDDWTDVR DYKLANDVKD
229E	NYCYVDHKKPH LSFPPLCSAGN VFGLYKNSAL GSMOVIDFNR LATSDDWTDVR DYKLANDAKE
PEDV	SYWCHCHKPR LAFPLCSAGN VFGLYKNSAT GSPDVEDFNR IATSDDWTDVS DYRLANDVKD
TGEV	SYCYCMNHKPK LSFPPLCSAGN VFGLYKNSAV GSEAVEDFNK LAVSDWNTVE DYKLANNVKE
BoCoV	SYCYCDHKKPK YSFKLVMNGH VFGLYKQSCT GSPYIDDFNR IASCKWTDVD DYILANECTE
OC43	SYCYCDHKKPK YSFKLVMNGL VFGLYKQSCT GSPYIDDFNR IASCKWTDVD DYILANECTE
MHV	SYCYCDHKKPK YSFKLVMNGH VFGLYKQSCT GSPYIEDFNK IASCKWTEVD DYVLANECTE
AIPV	SYFCGNHKKPK LSIPLVSNGT VFGLYRANCA GSENVDDFNQ LATTNWSIVE PYILANRCSO
SARS CoV	SYCYCKSHKPP ISFPPLCANGQ VFGLYKNTCV GSDNVTDENA IATCDWNTAG DYILANTCTE

	1085 1095 1105 1115 1125 1135
EMCR	TLRLFAAETI KAKEESVKSS YAFATLKEVV GPKELLLSWE SGKVKPLPNR NSVFTCFQIS
229E	SLRLFAAETV KAKEESVKSS YAYATLKEIV GPKELLLSWE SGKAKPPLNR NSVFTCFQIT
PEDV	SLRLFAAETI KAKEESVKSS YACATLHEVV GPKELLLSWE VGRPKPPLNR NSVFTCYHIT
TGEV	SLKIFAAETV KAKEESVKSE YAYAVLKEVI GPKELVQWE ASKTKPPLNR NSVFTCFQIS
BoCoV	RLKLFAAETQ KATEEAFKQS YASATIQEIV SERELILSWE IGKVKPLPNK NYVFTGYHFT
OC43	RLKLFAAETQ KATEEAFKQS YASATIQEIV SERELILSWE IGKVKPLPNK NYVFTGYHFT
MHV	RLKLFAAETQ KATEESFKQC YASATIREIV SDRELILSWE IGKVRPPLNK NYVFTGYHFT
AIPV	SLRLFAAETV KATEELHKQQ FASAEVREVF SDRELILSWE PGKTRPPLNR NYVFTGYHFT
SARS CoV	RLKLFAAETL KATEETFKLS YGIATVREVL SDRELILSWE VGKPRPPLNR NYVFTGYRVT

	1145 1155 1165 1175 1185 1195
EMCR	KDSKFQIGEF IFEKVEYGS DTVYKSTVTT KLVPGMIFVL TSHNVQPLRA PTIANQEKYS
229E	KDSKFQVGEF VFEKVDYGS DTVYKSTATT KLVPGMIFVL TSHNVQPLRA PTIANQEKYS
PEDV	KNTKFQIGEF VFEKAEDND AVTYKTATT KLVPGMIFVL TSHNVQPLRA PTIANQEKYS
TGEV	KDTHQIGEF VFEQSEYGS DTVYKSTSTY KLVPGMIFVL TSHNVQPLRA PTIANQEKYS
BoCoV	KNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHSVANLSA PTLVPQENYS
OC43	KNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHSVANLSA PTLVPQENYS
MHV	SNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHSVANLSA PTLVPQENYS
AIPV	RTSKVQLGDF TFEKGEG-KD VVYKATSTA KLSVGDIFVL TSHNVQPLRA PTLCPQOTFS
SARS CoV	KNSKVQIGEF TFEKGDY-GD AVVYRGTTY KLVNGDYFVL TSHNVQPLRA PTLVPQEHYV

	1205 1215 1225 1235 1245 1255
EMCR	SIYKLHPAFN VSDAYANLVP YYQLIGKQRI TTIOGPPGSG KSHCSIGLGL YYPGARIVFV
229E	TIYKLHPAFN VSDAYANLVP YYQLIGKQRI TTIOGPPGSG KSHCSIGLGL YYPGARIVFT
PEDV	TIHKLHPAFN IPEAYSSLVP YYQLIGKQRI TTIOGPPGSG KSHCVIGLGL YYPGARIVFT
TGEV	TISKLYPVFN IAEAYNTLVP YYQMIGKQRF TTIOGPPGSG KSHCVIGLGL YYPGARIVFT
BoCoV	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV YYCTARVVYT
OC43	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV FYCTARVVYT
MHV	SIR-FASVYS VPETFQNNVP NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV YYCTARVVYT
AIPV	RFVNLRLPVM VPECFVNNIP LYHLVGKQKR TTVOGPPGSG KSHFAIGLAV YFSSARVVFT
SARS CoV	RITGLYPTLN ISDEFSSNVA NYQKVGKQKY STLQGPPTG KSHFAIGLAV YFSSARIVYT

	1265 1275 1285 1295 1305 1315
EMCR	ACAAAVDSL CAKAMTVYSI DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPECN
229E	ACSHAAVDSL CAKAVTAYSV DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPEVN
PEDV	ACSHAAVDSL CVKASTAYSN DKCSRIIPQR ARVECYDGFK SNNTSAQYLF STVNALPECN
TGEV	ACSHAAVDSL CEKAAKNFNV DRCSRIIPQR IRVDCYTGFK PNNTNAQYLF CTVNALPEAS
BoCoV	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVECYDGFK INDTRKYVF TTINALPEMV
OC43	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVECYDGFK INDTRKYVF TTINALPEMV
MHV	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVDCYDGFK VNDTRKYVF TTINALPELV
AIPV	ACSHAAVDAL CEKAFKFLKV DOCTRIIPQR TTVDCFSKFK ANDTGKKYIF STINALPEVS
SARS CoV	ACSHAAVDAL CEKALKYLPPI DKCSRIIPAR ARVECFDGFK VNSTLEQYVF CTVNALPETT

	1325 1335 1345 1355 1365 1375
EMCR	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVMITKGMV EPVDYNVVTQ
229E	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVLISKGMV EPIDYNVVTQ
PEDV	ADIVVVDEVS MCTNYDLSVI NQRLSYRHVV YVGDPQQLPA PRVMISRGTL EPKDYNVVTQ
TGEV	CDIVVVDEVS MCTNYDLSVI NSRLSYKHIV YVGDPQQLPA PRTLINRGVL QPDYNVVVTQ
BoCoV	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
OC43	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
MHV	TDIVVVDEVS MLTNYELSVI NSRVRAKHIV YIGDPAQLPA PRVLLNKGTL EPRYFNSVTK
AIPV	CDILLVDEVS MLTNYELSVI NGKINYQYVV YVGDPQQLPA PRTLLN-GSL SPKDYNVVTN
SARS CoV	ADIVVFDEIS MATNYDLSVV NARIRAKHYV YIGDPAQLPA PRTLLTKGTL EPEYFNSVCR

	1385 1395 1405 1415 1425 1435
EMCR	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKPA SKQCFKIFFK G---NVQVDN
229E	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKEA SKQCFKIFER G---SVQVDN
PEDV	RMCAIGPDVF LHKCYRCPAE IVRTVSEMVY ENQFIPVHPD SKQCFKIFCK G---NVQVDN
TGEV	RMCTLGPDVF LHKCYRCPAE IVKTVSALVY ENKFVPVNPFE SKQCFKMFVK G---QVQIES
BoCoV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVVYK G---VTTSES
OC43	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVVYK G---VTTSES
MHV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNDN SSMCFKVVYK G---QTTSES
AIPV	LMVCVKPDIF LAKCYRCPKE IVDTVSTLVY DQKFIANNFE SRECFRVIVN NGNSDVGHES
SARS CoV	LMKTIGPDMF LGTCRRCPAE IVDTVSALVY DNKLKAHKDK SAQCFKMFYK G---VITHDV

	1445 1455 1465 1475 1485 1495
EMCR	GSSINRRQLE IVKLFLVKNP SWSKAVFISP YNSQNYVASR FLGLQIQTV D SSQGSEYDYV
229E	GSSINRRQLD VVKRFIHKNS TWSKAVFISP YNSQNYVAAR LLGLQQTVD SAQGSEYDYV
PEDV	GSSINRRQLD VVRMFIAKNP RWSKAVFISP YNSQNYVASR LLGLQIQTV D SSQGSEYDYV
TGEV	NSSINRRQLE VVKAFLAHNP KWRKAVFISP YNSQNYVARR LLGLQQTVD SAQGSEYDYV
BoCoV	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFPAKR VLGLQQTVD SAQGSEYDYV
OC43	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFPAKR VLGLQQTVD SAQGSEYDYV
MHV	SSAVNMQQIY LISKFLKANP SWSNAVFISP YNSQNYVAKR VLGLQQTVD SAQGSEYDYV
AIPV	GSAYNTTQLE FVKDFVCRNK QWREAFISP YNAMNQRAYR MLGLNVQTV D SSQGSEYDYV
SARS CoV	SSAINRRPQIG VVREFLTRNP AWRKAVFISP YNSQNAVASK ILGLPTQTV D SSQGSEYDYV

	1505 1515 1525 1535 1545 1555
EMCR	IYAQTSDTAH ACNVNRFNVA ITRAKKGIFC VMCDKT-LFD SLKFFEIKHA --DLHSS---
229E	IYAQTSDTAH ACNANRFNVA ITRAKKGIFC IMSDRT-LFD ALKFFEITMT --DLQSE---
PEDV	IYAQTSDTAH ASNVNRFNVA ITRAKKGILC IMCDRS-LFD LLKFELKLS --DLQAN---
TGEV	IYTQTSDTQH ATNVNRFNVA ITRAKVGILC IMCDRT-MYE NLDYFELKDS KIGLOAKP---
BoCoV	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTVD KVPQAVETRV
OC43	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTLD KVPQAVETRV
MHV	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSSMQ-LFE SLNFTSLTLD KIN---NPLR
AIPV	IFCVTADSQH ALNINRFNVA ITRAKRGILV VMQRDELYS ALKFTELDSE TSLQG-----
SARS CoV	IFTQTETETAH SCNVNRFNVA ITRAKIGILC IMSDRD-LYD KLQFTSLEIP RRN-VATLQA

	1565 1575 1585 1595 1605 1615
EMCR	-QVCGLFKNC TRTPLNLPPT HAHTFLSLSD QFKTTGDLAV QIGSNN--VC TYEHVISFMG
229E	-SSCGLFKDC ARNPIDLPPS HATTYLSLSD RFKTSGLAV QIGNNN--VC TYEHVISFMG
PEDV	-EGCGLFKDC SRGDDLLPPS HANTFMSLAD NFKTDQYLAV QIGVNG--PI KYEHVISFMG
TGEV	-ETCGLFKDC SKSEQYIPPA YATTYMSLSD NFKTSDGLAV NIG-TK--DV KYANVISFMG
BoCoV	QCSTNLFKDC SKSYSGYHHA HAPSFLAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
OC43	QCSTNLFKDC SKSYSGYHHA HAPSFLAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
MHV	QCTTNLFKDC SRSYAGYHHA HAPSFLAVDD KYKVGGLAV CLNVAD-SAV TYSRLISLMG
AIPV	---TGLFKIC NKEFSGYHHA YAVTTKALAA TYKVNDELA LNVVEAGSEI TYKHLISLLG
SARS CoV	ENVTLGFKDC SKIITGLHPT QAPTHLSVDI KFKTEG-LCV DIPGIP-KDM TYRRLISMMG

	1625	1635	1645	1655	1665	1675
EMCR	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLGM	DVESAHVCGD	NIGTNVPLQV	GFSNGVNFVV
229E	FRFDVSMPGS	HSLFCTRDFA	MRHVRGWLGM	DVEGAHVTD	NVGTNVPLQV	GFSNGVDFA
PEDV	FRFDINIPNH	HTLFCTRDFA	MRNVRGWLGF	DVEGAHVGS	NVGTNVPLQL	GFSNGVDVFF
TGEV	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTNVPLQL	GFSNGVDVFF
BoCoV	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
OC43	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
MHV	FKLDLTLDDGY	CKLFITRDEA	IRRVRAWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
AIPV	FKMSVNVGEC	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPLQV	GFSTGADFVV
SARS CoV	FKMNYQVNGY	PNMFITREEA	IRHVRWVGF	DVEGCHATRD	AVGTNLPLQL	GFSTGVNLVA

	1685	1695	1705	1715	1725	1735
EMCR	QTEGCVSTNF	GDVIKPVCAK	SPPGEQFRHL	VPFLRKQGPW	LIVRRRIVQM	ISDYLNLSD
229E	QPEGCVLTNT	GSVVKPVRAR	APPGEQFTHI	VPFLRKQGPW	SVLRKRIVQM	IADFLAGSSD
PEDV	RPEGCVVTES	GDYIKPVRAR	APPGEQFAHL	LPFLRKQGPW	DVVRKRIVQM	CSDYLANLSD
TGEV	QTEGCVITEK	GNSEIVVKAR	APPGEQFAHL	LPFLRKQGPW	HIVRRRIVQM	VCDYFDGLSD
BoCoV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGQRW	DVVRPRIVQM	FADHLIDLSD
OC43	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGQRW	DVVRPRIVQM	FADHLIDLSD
MHV	EATGMFAERD	GYVFKKAVAR	APPGEQFKHL	VPLMSRGQKW	DVVRIRIVQM	LSOHLVDLAD
AIPV	TPEGLVDTSI	GNNFEPVNSK	APPGEQFNHL	RVLFKSAKPW	HVIRPRIVQM	LADNLCNVSD
SARS CoV	VPTGVVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM	LSDTLKGSLD

	1745	1755	1765	1775	1785	1795
EMCR	ILVFLWAGS	LELTTRYFV	KIGPIKYCY-	CGNSATCYNS	VSNEYCCFKH	ALGCDYVYNP
229E	VLVFLWAGG	LELTTRYFV	KIGAVKHCO-	CGTVATCYNS	VSNDYCCFKH	ALGCDYVYNP
PEDV	ILVFLWAGG	LELTTRYFV	KIGPSKSCD-	CGKVATCYNS	ALHTYCCFKH	ALGCDYLYNP
TGEV	ILVFLWAGG	LELTTRYFV	KIGRPQKCE-	CGKSATCYSS	SQSVYACFKH	ALGCDYLYNP
BoCoV	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYGCGWRH	SVTCDYLYNP
OC43	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYGCGWRH	SVTCDYLYNP
MHV	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCV	CNKRATCFNS	RTGYGCGWRH	SYSCDYLYNP
AIPV	CVVFTWCHG	LELTTRYFV	KIGKEQVCS-	CGSRATTFNS	HTQAYACWKH	CLGDFDYVYNP
SARS CoV	RVVFLWAHG	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH	SVGFDYVYNP

	1805	1815	1825	1835	1845	1855
EMCR	YAFDIQQWGY	VGSLSNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKN	VDWTVTYPEI
229E	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKN	VDWSITYPMI
PEDV	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKN	VDWSITYPMI
TGEV	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKN	VDWSITYPMI
BoCoV	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN	INWNVYPII
OC43	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN	INWNVYPII
MHV	LIVDIQQWGY	TGSLTSSNHDL	ICSVHKGAVH	ASSDAIMTRC	LAVHDCFVKS	VNWSLEYPII
AIPV	LIVDIQQWGY	SGNLQFNHDL	HCNVHGHAVH	ASVDAIMTRC	LAINNAFCQD	VNWDLYPHI
SARS CoV	FMIDVQQWGF	TGNLQSNHDO	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKN	VDWSVEYPII

	1865	1875	1885	1895	1905	1915
EMCR	ANEKFIINGCG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDKAWY	CYDKQPVNSN
229E	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDKAWY	CYDKNPINSN
PEDV	GNEAVINKSG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDKAWY	CFDKNPINSN
TGEV	DNEEKINKAG	RIVQSHIMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPW	CYDRDPINNN
BoCoV	SNELISINTSC	RVLQRMVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
OC43	SNELISINTSC	RVLQRMVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
MHV	SNEVSVNTSC	RLQRMVIFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK	FYDASPVVKS
AIPV	ANEDEVNSSC	RYLQRMVILNA	CVDALKVNVV	YDIGNPKGIR	CVRRGDVNFR	FYDKNPINRN
SARS CoV	GDELRVNSAC	RKVQHMVVKK	ALLADKFPVL	HDIGNPKAIA	CVPQAEVEWK	FYDAQPCSDK

	1925	1935	1945	1955	1965	1975
EMCR	---VKLLDYO	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSVF	NLEGVNGGSL
229E	---VKTLEYD	YATHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL	NLEGVNGGSL
PEDV	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL	NLEGVNGGSL
TGEV	---VRCLOYD	YMVHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL	SLEGVNGGSL
BoCoV	---VKTLLFY	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
OC43	---VKTLLFY	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
MHV	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
AIPV	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLVSF	NLPGCNGGSL
SARS CoV	AYKTEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLNNL	NLPGCNGGSL

	1985	1995	2005	2015	2025	2035
EMCR	YVNNHAFHTP	AYDKRAFVKL	KMPFFFYDD	SDCDVVC---	-EQVNYVPLR	ASSCVTRCNI
229E	YVNNHAFHTP	AYDKRAMAKL	KPAFFFYDD	GSCEVH---	-DQVNYVPLR	ATNCITKCN
PEDV	YVNNHAFHTP	AFDKRAFAKL	KMPFFFYDD	TECDKLQ---	-DSINYVPLR	ASNCITKCN
TGEV	YVNNHAFHTP	AYDRRAFAKL	KMPFFFYDD	SNCELVD---	-GQPNYVPLR	SNVCITKCN
BoCoV	YVNNHAFHTK	PFSRAAFELH	KMPFFFYDD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
OC43	YVNNHAFHTK	PFSRAAFELH	KMPFFFYDD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
MHV	YVNNHAFHTS	PFTRAAFENL	KMPFFFYDD	TPCVYMDGME	SKQVDYVPLR	SATCITRCNL
AIPV	YVNNHAFYTP	KFDRISFRNL	KAMPFFFYDD	SPCETIQ-VD	GVAQDLVSLA	TKDCITKCN
SARS CoV	YVNNHAFHTP	AFDKSAFTNL	KQLPFFFYDD	SPCESHGKQV	VSDIDYVPLK	SATCITRCNL

	2045	2055	2065	2075	2085	2095
EMCR	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL	QSLNIAFNV
229E	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL	OGLNIAFNV
PEDV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFSN--NL	OGLNIAFNV
TGEV	GGAVCKKHA	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNSKAL	QSLNIAFNV
BoCoV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNIAFNV
OC43	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNIAFNV
MHV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNIAFNV
AIPV	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFS---L	QSIDNIAFNV
SARS CoV	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTK---L	QSLNIAFNV

	2105	2115	2125	2135	2145	2155
EMCR	VKKGCFGTVD	GELPVAVVND	KVFVRDGDVD	NLVFTNKTTL	PTNVAFELFA	KRKMGLTPPL
229E	VNKGSEFVGD	GELPVAISGD	KVFVRDGNTO	NLVFVNKTSL	PTNIAFELFA	KRKGVLTPPL
PEDV	LKKGSFVGD	GELPVAVVND	KVLVRDGTVD	TLVFTNKTSL	PTNVAFELFA	KRKGVLTPPI
TGEV	VKKGAFGLK	GDLPTAVIAD	KIMVRDGPDT	KCIFTNKTSL	PTNVAFELFA	KRKLGLTPPL
BoCoV	VKTGHYTQGA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSIRHHPPL
OC43	VKTGHYTQGA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSVRHHPPL
MHV	VNAGHFDGRA	GELPCAVIGE	KVIAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSIRHHPPL
AIPV	YKGGHYDATA	GEMPTVITGD	KVFVIDQGVE	KAVFVNQTTL	PTSVAFELFA	KRNIRLTPNN
SARS CoV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELFA	KRNIRLTPNN

	2165	2175	2185	2195	2205	2215
EMCR	SILKNLGVVA	TYKFLWDYE	AERPFTSYTK	SVCKYTDEN-	-----EDV	CVCFDNSIQG
229E	SILKNLGVVA	TYKFLWDYE	AERPLTSFTK	SVCGYTDFA-	-----EDV	CTCYDNSIQG
PEDV	TILRLNLGVC	TSKCVIWDYE	AERPLTFTFK	DVCKYTDEN-	-----GCV	CTCFDNSIQG
TGEV	TILRLNLGVC	TYKFLWDYE	AERPFSNFTK	QVCSYTDLD-	-----SEV	VTCFDNSIAG
BoCoV	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----LIDKL	NVLFDGRDNG
OC43	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----FIDKL	NVLFDGRDNG
MHV	KLFRNLNIDV	CWKHVIWDYA	KDSVFCSSSTY	KVCKYTDLQ-	-----CIESL	NVLFDGRDNG
AIPV	RILKGLGVVD	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE-	-----PNGL	VVLYDDR-YG
SARS CoV	KILNLGVVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIAK	KPTESACSSL	TVLFDGRVGE

	2225	2235	2245	2255	2265	2275
EMCR	SYERTTLTN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV	EKLNVWYTYV
229E	SYERTTLTN	AVLFSTVVIK	TGGKSLPAIK	LNFGMLNGNA	IATVKSENGN	IKNINWVYVY
PEDV	SLERFSMTQN	AVLMSLTAVK	K-----LTGK	LYGYLNGVP	VNTHED----	-KPFTWYIYT
TGEV	SFERFTTTTRD	AVLISNNAVK	G-----LSA	LYGYLNDLP	VSTVGN----	-KPVWYIYV
BoCoV	ALFAFKRSNN	GVYISTTKVK	S-----LSMIR	GPRAELNGV	VVDKVGDD--	-TDCVFYFAV
OC43	ALFAFKRSNN	GVYISTTKVK	S-----LSMIR	GPRAELNGV	VVDKVGDD--	-TDCVFYFAV
MHV	ALFAFKKCRD	GVYINTTKIK	S-----LSMIR	GPRAELNGV	VVEKVGDD--	-SDVEFWFAM
AIPV	DYQSFALAADN	AVLVSTQCYK	R-----YSYVE	IPSNLLVQNG	MPLKDG----	-ANLYVYK
SARS CoV	QVDLFRNARN	GVLTTEGSKV	G-----LTPSK	GPAQASVNGV	TLIGES----	-VKTQFNFK

	2285	2295	2305	2315	2325	2335
EMCR	RKNG-----	Y-----QFQDH	Y-----	Y-----	Y-----	Y-----
229E	RKNG-----	Y-----KPVVDH	Y-----	Y-----	Y-----	Y-----
PEDV	RKNG-----	Y-----KFEDY	Y-----	Y-----	Y-----	Y-----
TGEV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----
BoCoV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----
OC43	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----
MHV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----
AIPV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----
SARS CoV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----	Y-----

	2345	2355	2365	2375	2385	2395
EMCR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQFR	LKMGVLKAD
229E	SDMEYDFLNM	DIGVFIQKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR	LKMGILKAE
PEDV	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR	LACMGVLKID
TGEV	SDMEYDFLNM	DTTLFIQKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR	LAKMGVLSVQ
BoCoV	SDMEYDFLNM	DQDVFIQKYG	LEDNFNEHVV	YGNFNQKIIG	GLHLLISQVR	RQQTSLNVIQ
OC43	SDMEYDFLNM	DQDVFIQKYG	LEDNFNEHVV	YGNFNQKIIG	GLHLLISQVR	RQQTSLNVIQ
MHV	SDMEYDFLNM	DQDVFIQKYG	LEDNFNEHVV	YGNFNQKIIG	GLHLLISQVR	RQQTSLNVIQ
AIPV	SDMEYDFLNM	SEESFVERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR	LLRANKLNAK
SARS CoV	SDMEYDFLNM	AMDEFIQRKY	LEGYAFEHIV	YGDVSHGQLG	GLHLMIGLAK	RSQDSPLKLE

	2405	2415	2425	2435	2445	2455
EMCR	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLG	VISKVHEVII
229E	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLT	VVSKVHEVII
PEDV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLT	VVSKVHEVII
TGEV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV
BoCoV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV
OC43	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV
MHV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV
AIPV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV
SARS CoV	DEFVTSADTTL	RCCTVTYLYNE	LSSKVVCTYM	DLLDDFVFTI	LK---SLDLN	VVSKVVDVIV

	2465 2475 2485 2495 2505 2515
EMCR	DNKPYRWMLW CKDNHLSSTFY PQLQS-AEWK CGYAMPQIYK LQRMCLPCN LYNYGAGIKL
229E	DNKPYRWMLW CKDNVATFY PQLQS-AEWK CGYSMPGIYK TQRMCLPCN LYNYGAGIKL
PEDV	DCMKWRWMLW CKDHKLQTFY PQLQA-SEWK CGYSMPGIYK IQRMCLPCN LYNYGAGIKL
TGEV	DCKAWRWMLW CENSHIKTFY PQLQS-AEWK PGYSMPTLYK IQRMCLPCN LYNYGAGIKL
BoCoV	DFKDFQFMLW CNDEKVTTFY PRLQAASDWK PGYSMPVLYK YLNSPMERVS LWNYGKPVTL
OC43	DFKDFQFMLW CNDEKVTTFY PRLQAASDWK PGYSMPVLYK YLNSPMERVS LWNYGKPVTL
MHV	DFKDFQFMLW CNEEKVMTFY PRLQAASDWK PGYSMPVLYK YLNSPLERVN LWNYGKPVTL
AIPV	DYHSINFTW FEDGSIKTCY PQLQS--AWT CGYNMPELYK VQNCVMEPCN IPNYGVGITL
SARS CoV	DYAEISFMLW CKDGHVETFY PKLQASQAWQ PGVAMPNLYK MQRMLEKCD LQNYGENAVI

	2525 2535 2545 2555 2565 2575
EMCR	PSGIMLNWVK YTQLCQYLSN TTMCPVPHNR VLHYGAGSDK GVAPGTTLVK RWLPPD----
229E	PSGIMFNWVK YTQLCQYFNS TTLCPVPHNR VLHLGAGSDY GVAPGTAVLK RWLPHD----
PEDV	PDGIMFNWVK YTQLCQYLSN TTMCPVPHNR VLHLGAGSDK GVAPGTAVLR RWLPLD----
TGEV	PDGITTWVK YTQLCQYLSN TTLCPVPHNR VLHLGAGSAS GVAPGSTVLR RWLPPD----
BoCoV	PTGCMNVAK YTQLCQYLSN TTLAVPVNTR VLHLGAGSEK GVAPGSAVLR QWLPAGTILR
OC43	PTGCMNVAK YTQLCQYLSN TTLAVPVNTR VLHLGAGSEK GVAPGSAVLR QWLPAG----
MHV	PTGCMNVAK YTQLCQYLSN TTLAVPANMR VLHLGAGSDK DVAPGSAVLR QWLPAG----
AIPV	PSGIMLNWVK YTQLCQYLSK TTICVPHNR VMHFGAGSDK GVAPGSTVLK QWLPAG----
SARS CoV	PKGIMNVAK YTQLCQYLSN TTLAVPVNMR VIHFGAGSDK GVAPGTAVLR QWLPAG----

	2585 2595 2605 2615 2625 2635
EMCR	-----AIII DNDINDYVSD ADFSITGDCA TVYLEDKFDL LISDMYDG-- --RIKFCDE
229E	-----AIVV DNDVDYVSD ADFSITGDCA TVYLEDKFDL LISDMYDG-- --RTKADGE
PEDV	-----AIIV DNDSDYVSD ADYSVTGDCA TLYLSDKFDL VISDMYDG-- --RIKSCDE
TGEV	-----AILV DNDLRYVSD ADFSITGDCT SLYIEDKFDL LVSDLYDG-- --STKSIDG
BoCoV	QWLPAGTILV HNDLYPFVSD SVATYFGDCI TLPPDCQWDL IISDMYD-- --LLLDIGVH
OC43	-----TILV DNDLYPFVSD SVATYFGDCI TLPPDCQWDL IISDMYD-- --ITKNIGY
MHV	-----SILV DNDINPFVSD SVASYYGNCI TLPIACQWDL IISDMYD-- --LTKNIGY
AIPV	-----TLV DNDIDYVSD AHVSVLSDCN KYNTEHKFDL VISDMYTND SKRKHGVIA
SARS CoV	-----TLV DNDLDFVSD ADSTLIGDCA TVHTANKWDL IISDMYD-- --RTKHVTE

	2645 2655 2665 2675 2685 2695
EMCR	NVSKDGFYTY LNVGIREKLA IGGSAIAKIT EYSWNKLYE LIQRFAPWTL FCTSVNTSSS
229E	NVSKDGFYTY INGFIKELA IGGSAIAKIT EYSWNKLYE LVQRFAPWTL FCTSVNTSSS
PEDV	NVSKDGFYTY INGVIKELA LGGTVAIKIT EFSWNKLYE LIQKFEYWTM FCTSVNTSSS
TGEV	NVSKDGFYTY INGFIKELLS LGGSAIAKIT EFSWNKLYE LIQRFAPWTL FCTSVNTSSS
BoCoV	VVRCS---YI HCHMIRDKLA LGGSAIAKIT EFSWNAELYK LMGYFAFWTV FCTNANASSS
OC43	NVSKDGFYTY ICHMIRDKLA LGGSAIAKIT EFSWNAELYK LMGYFAFWTV FCTNANASSS
MHV	NVSKDGFYTY LCHLIRDKLA LGGSAIAKIT EFSWNAELYS LMGKFAFWTI FCTNANASSS
AIPV	NNGNDVFIY LSSFLRNLA LGGSAIAKIT ETSWHEVLYD IAQDCAWWTM FCTAVNASSS
SARS CoV	NVSKDGFYTY LCGFIKELA LGGSAIAKIT EHSWNADLYK LMGHFSWWTM FVTNANASSS

	2705 2715 2725 2735 2745 2755
EMCR	EAFLLIGINYL GDFIQGFPIA GNTVHANYIF WRNSTIMSLS YNSVLDLSKF ECKHKATVVV
229E	EAFVVGINYL GDFIQGFPIA GNTVHANYIF WRNSTIMSLS YNSVLDLSKF ECKHKATVVV
PEDV	EAFLLIGVHYL GDFASGAVID GNTMHANYIF WRNSTIMTMS YNSVLDLSKF ECKHKATVVV
TGEV	EGFLIGINYL GPYCDKAIVD GNTMHANYIF WRNSTIMALS HNSVLDTPKF KCRCNALIV
BoCoV	EGFLIGINYL GK--PKVEID GNMVHAIICF G----- EIPQFGTGLV
OC43	EGFLIGINYL CK--PKVEID GNMVHANYLF WRNSTVWNGG AYSLFDMAKF PLKLAGTAVI
MHV	EGFLIGINYL NR--TRTEID GNTMHANYLF WRNSTVWNGG AYSLFDMSKF PLKVAGTAVV
AIPV	EAFLLIGVHYL GAS-EKVVS GNTLHANYIF WRNCNYLQTS AYSLFDMAKF DLRLKATPVV
SARS CoV	EAFLLIGANYL GK--PKEQID GNTMHANYIF WRNTNPIQLS AYSLFDMSKF PLKLRGTAVM

	2765 2775 2785 2795
EMCR	TLKOSDVNDM VLSLIRSGRL LLRNSGRFGG FSNHLVSTK-
229E	QLKOSDVNDM VLSLIRSGRL LLRNSGRFGG FSNHLVSTK-
PEDV	NLKDSSISDV VLGLLRNGKL LVRNDAICG FSNHLVNVK
TGEV	NLKEKELNEM VIGLLRNGKL LVRNDAICG FGNHFNTP-
BoCoV	IACLIWLSNR LSWLVMP--- -----
OC43	NLRADQINDM VYSLLEKGL LIRDNTKEVF VGOSLVNVI-
MHV	SLKPDQINDL VLSLIRSGRL LVRDTRKEVF VGOSLVNVI-
AIPV	NLKEQKTDL VFNLIKCGKL LVRDVGNTSF TSDFSVCMT-
SARS CoV	SLKENQINDM IYSLLEKGL IIRENNRVVV SSDILVNN--

d. Putative Orf lab

	5	15	25	35	45	55
EMCR	-----	-----	-M FYNQVTLAVA	SDSEISGFGF	AIPSVAVRAY	SEAAAQGFQA
229E	-----	-----	-M ACNRVTLAVA	SDSEISANGC	STIAQAVRRY	SEAAASNGFRA
PEDV	-----	-----	-M ASNHVTLAFA	NDAEISAFGF	CTASEAVSY	SEAAAAGFMQ
TGEV	-----	-----	-M SSKQFKILVN	EDYQVNVPSL	PIR-DVLQEI	KYCYRNGFEG
OV43	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDMIC	STTAQKLETG	GICPENHVMV
BoCoV	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDIVC	STTAQKLETG	GICPENHVMV
MHV	MAKMGKYLGL	FKWAPEFPWM	LPNASEKLGS	PERSEEDGFC	PSAAQEPKTK	GKTLINHVVR
AIBV	-----	-----	MASSLRQGV	PKPRDVILVS	KDIPEQLCDA	LFFYTSHNPK
SARS CoV	-----	-----	MESLVLGV	NEKTHVQLSL	PVLQVRDVLV	RGFSDSVEEA
						LSEAREHLKN
	65	75	85	95	105	115
EMCR	CRFVAFGLQD	CVTGINDDDY	VIALTG----	-----	TNQLCAKILL	FSDRPLNLRG
229E	CRFVSLDLQD	CIVGIADDTY	VMGLHG----	-----	NQTLFCNIMK	FSDRPFMLHG
PEDV	CRFVSLDLAD	TVEGLLPEDY	VMVVG----	-----	TTKLSAYVDT	FGSRPRNICG
TGEV	YVVFPEYCRD	LVDCKDRDHY	VIGVLG----	-----	NGVSDLKPV	LTEPSVMLQG
OV43	DCRRLLKQEC	CVQSSLIREI	VMNASPYDLE	VLLQDALQSR	EAVLVTTPLG	MSLEACYVRG
BoCoV	DCRRLLKQEC	CVQSSLIREI	VMNTRPYDLE	VLLQDALQSR	EAVLVTPPLG	MSLEACYVRG
MHV	DCSRLPALEC	CVQSAIIRDI	FVDEDPLNVE	ASTMMALQFG	SAVLVKPSKR	LSIQAWAKLG
AIBV	DYADAFVVRQ	KFDRSLQTGK	QFKFET----	-----	CGLFLLKGVD	KITPGVPAKV
SARS CoV	GTCGLVELEK	GVLPQLEQPY	VFIKR--SDA	LSTNHGHKVV	ELVAMDGIQ	YGRSGITLGV
	125	135	145	155	165	175
EMCR	WLIFSNSNYV	LQDFDVVFG-	-HGAGSVVVF	DKYMGCFDGK	PVLP--KNMW	EFRDYFNDNT
229E	WLIVFSNSNYL	LEEDFVDFGK	-RGGGNVTYT	DQYLCGADGK	PVMS--EDLW	QFVDHFGENE
PEDV	WLLFSNCFNYF	LEELELTFFG-	-RRGGNIVPV	DQYMGADGK	PVLQ--EESW	EYTDFFADSE
TGEV	FIVRANCNGV	LEDFDLKIA-	-RTGRGAIYV	DQYMGADGK	PVIE--G---	DFKDYFGDED
OV43	CNPKGWTMGL	FRRRSVCNTG	RCTVNKHVAY	QLYMIDPAGV	CLGAGQFVGW	VIPLAFMPVQ
BoCoV	CNPNGWMTMGL	FRRRSVCNTG	RCAVNKHVAY	QLYMIDPAGV	CFGAGQFVGW	VIPLAFMPVQ
MHV	VLPKTPAMGL	FKRFLCNTR	ECVCDAHVAF	QLFTVQPDGV	CLGNRFIGW	FVPVTAIPAY
AIBV	LKATSKLADL	EDIFGVSPLA	RKYRELLKTA	CQWSLTVEAL	DVR-----AQ	TLDEIFDPTF
SARS CoV	LVPHVGETPI	AYRNVLLRK-	--NGNKGAGG	HSYGIDLKSY	DLG--DELGT	DPIDIEYQNW
	185	195	205	215	225	235
EMCR	DS-IVIGGV	YQLAWDVIRK	DLSEYQQNV	ALIESIHYLG-	TTGHTLKS	KLINAKPPKY
229E	E--IIINGHT	YVCAWLTKRK	PLDYKRQNNL	ALIEIEYVHG	DALHTLRNGS	VLEMAKEVKT
PEDV	DGQLNIAGIT	YVKAWIVERS	DVSYASQNL	SIKSITYCS-	TYEHTFLDGT	AMKVARTPKI
TGEV	--IIEFEGEE	YHCAWTTVRD	EKPLNQQTFL	TIQEIQYNL-	DIPHKLPNCA	TRHVAPPVKK
OV43	SRKFIVPVWM	YLRKRGEKGA	YKNDHGRGGF	GH-VYDFKVE	DAYDQVHDEP	KGKFSKKAYA
BoCoV	SRKFIVPVWM	YLRKCEKGA	YIKDYKRGGF	EH-VYNFKVE	DAYDLVHDEP	KGKFSKKAYA
MHV	AKQWLQPSWI	LLRKGGNKG	VTSGHFRRAV	TMPVYDFNVE	DACEEVHLNP	KGKYSRKAYA
AIBV	ILWLQVAAKI	HVSSMAMRRL	VGEVTAQVMD	ALG-----	SNLSALFQIV	KQIARIQFK
SARS CoV	NTKHGSGALR	ELTRELNNGA	VTRYVDNNFC	GPDGYPLDCI	KDFLARAGKS	MCTLS-EQLD
	245	255	265	275	285	295
EMCR	SSKVVLSGEW	NAVYKAFGSP	FITNGISLLD	IIVKPVFFNA	FVKCNCGSEN	WSVGAWDGYL
229E	SSKVVLSDAL	DKLYKVFSGP	VMTNGSNILE	AFTKPVFISA	LVQCTCGTKS	WSVGWDWTFK
PEDV	KKNVVLSEPL	ATIIYREIGSP	FVDNGSDARS	IIRRPVFLHA	FVKCKCGSYH	WTVGDWTSYV
TGEV	NSKIVLSEDY	KKLYDIFGSP	FMGNGDCLSK	CFDTLHFIAA	TLRCPGCGSES	SGVGDWTFK
OV43	LIRGYRGVVK	LLYVDQYQCD	YTGLADGLE	AYADKTLQEM	KALFPTWSQE	LLFDVIVAWH
BoCoV	LIRGYRGVVK	LLYVDQYQCD	YTGLADGLE	AYADKTLQEM	KALFPTWSQE	LPFDVTVAWH
MHV	LLKGYRGVKS	ILFLDQYQCD	YTGLAKGLE	DYGDCTLEEM	KELFPVWCDS	LDNEVVVAWH
AIBV	ALAI FENVNE	LPQRIAAALM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE
SARS CoV	YIESKRGVYC	CRDHEHEIAW	FTERSDKSYE	HQTPFEIKSA	KKFDTFKGEC	PKFVFPLNSK
	305	315	325	335	345	355
EMCR	SSCCGTPAKK	LCVVPGNVVP	GDVIITSTDA	GCGVKYYAGL	VVKHITNITG	VSLWRVTAHV
229E	SSCCNVISNK	LCVVPGNVVK	GDAVITTQQA	GAGIKYFCGM	TLKEVANIEG	VSVMRVIALQ
PEDV	STCCGFKCKP	VLVASCASMP	GSVVVTRAGA	GTGVKYYNM	FLRHVADIDG	LAFWRILKVO
TGEV	TACCGLSGKV	KGVTGLDIKP	GDAVVTMSA	GKGVKEFFANC	VLQYAGDVEG	VSIVKVIKTF
OV43	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSSVVIKEP	VHVYADDSII	LRQYNLVDIM
BoCoV	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSSVVIKEP	VHVYADDSII	LRQYNLVDIM
MHV	VDRDPRVAVR	LQTLATIRSI	GYVGQPTEDL	VOGDVVVREP	AHLAANAIV	KRLPRLVETM
AIBV	ELPNFGMGSK	IFTTLAFFKE	AARVVVENIP	NAPRGTKGFE	VVGNAKGTQV	VVRGMRNDLT
SARS CoV	VKVIQPRVEK	KKTEGFMGRI	RSVYPVASPO	ECNNMHLSTL	MKCNHCDEV	WQTCDFLTKAT

	365	375	385	395	405	415
EMCR	SDGMFVATSS	YDALLHRNSL	DPFCFDVNTL	LSNQLRLAFL	GASVTEDEVKF	A-----AST
229E	SVDCFVASST	FVEEHHVNRN	DTFCFNVNRN	VTDECRLAML	GAEMTSNVRR	Q-----VAS
PEDV	SKDDLACSGK	FLERHEEGFT	DPYFLNDSS	LATKLKFDIL	SGKFSDEVQK	A-----IIA
TGEV	TVDETVCPTG	FEGELN----	DFIKPESKSL	VACSVKRAFI	TGDIIDAVHD	C-----IIT
OV43	SHFYMEADTV	VNAFYGVALK	DCGFVMQFGY	IDCEQDSCDF	KGWIPGNMID	G---FACTTC
BoCoV	SCFYMEADAV	VNAFYGVDLK	DCGFVMQFGY	IDCEQDLCDF	KGWVPGNMID	G---FACTTC
MHV	LYT---DSSV	TEFCYKTKLC	DCGFITQFGY	VDCCGDACDF	RGWVPGNMMD	G---FLCPGC
AIBV	LLDQKADIPV	EPEGWS----	--AILDGHLK	YVFRSGDRFY	AAPLSGNFAL	S-----
SARS CoV	CEHCCTENLV	IEGPTTCGYL	PTNAVVKMPC	PACQDPEIGP	EHSVADYHNH	SNIETRLRKG

	425	435	445	455	465	475
EMCR	GVIDISAGMF	GLYDDILTNN	KPWFVRKASG	LFDAIWDAFV	AAIKLVPTTT	GGLVRFVKSI
229E	GVIDISTGWF	DVYDDIFAES	KPWFVRKAED	IFGPCWSALA	SALKQLKVTT	GELVRFVKSI
PEDV	GHVVVGSALV	DIVDDALG--	QPWFIRKLGD	LASAPWEQLK	AVVRGLGLLS	DEVVLFGRRL
TGEV	GKLDLSTNLF	GNVGLLFKK-	TPWFVQKCGA	LFVDANKVVE	ELCGSLTLTY	KQIYEVVASL
OV43	GHVYEVGDLI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
BoCoV	GHVYETGDLL	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
MHV	SKSYMPWELE	AQSSGVIPKG	GVLEFQSTDT	VN----RESE	KLYGHAVVPF	GSAYVWSPYP
AIBV	-DVHCCERVV	CLSDGVTP--	--EIN--DGL	ILAAIYSSFS	VSELVTALKK	GEPFKFLGHK
SARS CoV	GRTRCFGGCV	FAYVGCYNKR	AYWVPRASAD	IG----SGHT	GITGDNVETL	NEDLLEILSR

	485	495	505	515	525	535
EMCR	ASTVLTVSNG	VIIMCADVPD	AFQPVYRTFT	QAICAAFDPS	LDVFKIG--	-----
229E	CNSAVAVVGG	TIQILASVPE	KFLNADFVVF	TAIQTVFDCA	VETCTIA--	-----
PEDV	SCATLSIVNG	VFEFLADVPE	KLAAAVTVVF	NELNEFFESA	CDCLKVGG	-----
TGEV	CTSAFTIVNY	KPTFFVVPD-N	RVKDLVDKCV	KVLKRAFDVF	TQIITIAG--	-----
OV43	NWIPIILKSS	VKSYSLSVYT	GVLGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
BoCoV	NWIPIILKSS	VKSYSLSVYT	GVVGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
MHV	GMWLPIWISS	VKSADLTLYT	GVVGCKAIVQ	ETDAICRSLY	MDYVQHKCGN	LEQRAILGLO
AIBV	---FVYAKDA	AVSFTLAKAA	TIADVLRFLQ	SARVIAEDVW	SSFTEKS--	-----
SARS CoV	---ERVNINI	VGDFHLENEV	AIILASFAS	TSAFIDTIKS	LDYKSFKT-I	VESCGNYKVT

	545	555	565	575	585	595
EMCR	---DVKEFR	LGDYVLTENA	LVRLTTEVVR	GVRD-----	-----	---A-----
229E	---GKAFDK	VFDYVLLDNA	LVLKLVTKLK	GVR-----	-----	---R-----
PEDV	---GKTFNK	VGSYVLFDNA	LVLKLVKAKAR	GPRQ-----	-----	---A-----
TGEV	---IEAKCFVL	GAKYLLFNNA	LVLKLVSVKIL	GKKQ-----	-----	---K-----
OV43	DVWHKQLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
BoCoV	DVWHKQLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
MHV	DVYHRQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FA---	TCGDGLVPLL	LDGLVPRSY
AIBV	-----	FEWKLAYGK	VRNLEEFVKT	YVCK-----	-----	-----
SARS CoV	KGKPKVGAWN	IGQORSVLTP	LCGFPSQAAG	VIRSIFARTL	DAANHSIPDL	QRAAVTILDG

	605	615	625	635	645	655
EMCR	-RIKKAMETK	VVVGPTTEVK	FSVIELATVN	LRLVDCAPVV	CPKGKIVVIA	GQAFFVSGGF
229E	-GLNKVYAT	VVVGSTTEVK	SSRVERSTAV	LTIANNSYKL	FDEGYTVVIG	DVAYFVSDGY
PEDV	-GICEVRYTS	LUVGSTTKVV	SKRVENANVN	LVVVDEDVTL	NTTGRTVVVD	GLAFFESDGF
TGEV	-GLECAFEAT	SLVGATVNV	PKRTETATIS	LKNKVDVVAP	G-EGYIVIVG	DMAFYKSGEV
OV43	LAVSQGAFCO	YADKLCHAVV	SKSKELLDVS	LDSLGAIIHY	LNSKIVDLAQ	HFSDFGTSFV
BoCoV	LAVSQGAFCO	YAGKICHAVV	SKSKELLDVS	VDSLGAIIHY	LNSKIVDLAQ	HFSDFGTSFV
MHV	LKSKQAFTS	MMVNFSEHVT	DMCMDMALLE	MHDVKVATKY	VKKVTGKLAV	RFKALGVAVV
AIBV	AQMSIVILAA	VLGEDIWHLV	SOVIYKLGVL	FTKVVDFCDK	HWKGFVCQLK	RAKLIVTETF
SARS CoV	ISEQSLRLVD	AMVYTSDDL	NSVIIMAYVT	GGLVQOTSQW	LSNLLGTTVE	KLRPIFEWIE

	665	675	685	695	705	715
EMCR	YRFVVDSTTV	LNDPVFTGEL	FYTIKFSGFK	LDGFN-----	---HQFVNAS	SATDAIIAVE
229E	FRLMASPNSV	LTTAVYKPLF	AFNVNVMGTR	PE-----	---KFPTTV	TCELESALV
PEDV	YRHLADADV	IEHPVYKSAC	ELKPVFECDP	IP--D-----	---FPLPVAA	SVAELCVQTD
TGEV	YFMMSSPNFV	LTNNVFKAVK	VPSYDIVYDV	DNDTKSKMIA	KLGSSEFYOG	DIDAIVKVN
OV43	SKIVHFFKTF	TTSTALAFW	VLHVLHGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
BoCoV	SKIVHFFKTF	TTSTALAFW	VLHVLHGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
MHV	RKITEWFDLA	VDTAASAAGW	LCYQLVNGLF	AVANGGITFL	SD-VPELVKN	FVDKPKVFFK
AIBV	CVLKGVAQHC	FQLLLDAIHS	LYKSFKKCAL	GRIHG-----	---DLLFWKGG	VHKIVQDGE
SARS CoV	AKLSAGVEFL	KD-----AWE	ILKFLITGVF	DIVKGQIQVA	SDNIKDCVKC	FIDVVNKALE

	725	735	745	755	765	775
EMCR	LLLSDFKTAV	FVYTCVVDCG	SVIVRRDAT-	FATHVCFKDC	YSIWEQFCID	NCGE-----
229E	FVNDKITEFQ	LDYSIDVIDN	EIIKPNIS-	LCVPLYVRDY	VDKWDDFCRQ	YSNE-----
PEDV	LLLNKYNTPY	KTYSCVVRGD	KCCITCTLQ-	FKAPSYVEDA	VN-FVDLCTK	NIGT-----
TGEV	ELLIEFRQOS	LCFRAFRDDK	SIFVEAYFKK	YKMPACLAKH	IG-LWNIIKK	DSCK-----
OV43	VVLDLVRVTF	IDGLSCFKIG	RRRICLSGRK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
BoCoV	VGLDSLVRVTF	IDGLSCFKIG	RRRICLSGSK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
MHV	VLDMSVSVS	LSGLTVVTKA	SNRVCLAGCK	VYEVVQK-RL	SAVYMPVGCN	EATC-----
AIBV	IWFDAIDSVD	VEDLGVVQEK	SIDFEVCDV	TLPENQPGHM	VOIEDDGKNY	MFFR-----
SARS CoV	MCIDQVTIAG	AK-LRSLNLG	EVFIAQSKGL	YRQCIRGKEQ	LQLLMLPKAP	KEVT-----

	785	795	805	815	825	835
EMCR	-----PW	FLTDYNAILQ	SNMPOCAIVQ	ASESK-----	--VLLERFLP	KCP EILLSID
229E	-----SW	FEDDYRAFIS	VLDITDAAVK	AAESK-----	--AFVDTIVP	PCPSILKVID
PEDV	-----AG	FHEFYITAEH	QDLQGLFTT	CCTMSG-----	F-ECFMPTIP	QCPAVLEEID
TGEV	-----RG	FLNLFNHLNE	LEDIKETNIQ	AIKN-----	-----I-	LCPDPLLDLD
OV43	AKQKPIYLKG	SGSDFSLADS	VVEVVTTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
BoCoV	TKQRGIYLLG	SGSDFSLADS	VVEVVTTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
MHV	-----LVG	EIEPAVVEDD	VVDVVKAPLT	YQG-----CC	KPPTSFEKIC	VVDKLYMAK
AIBV	-----FKK	DENIYYTPMS	QLGAINVVCK	AGG-----	-----KTVT	FGETTVQEIIP
SARS CoV	-----FLEG	DSHDTVLTS	EVVLKNGELE	ALETFPVDSFT	NGAIVGTPVC	VNGLMLLEIK
	845	855	865	875	885	895
EMCR	DGHLWNLFVE	K-----	-FNFVTDWLK	TLKLTLSNG	LLGNCAKFR	RVLVKLLDVOY
229E	GGKIWNNGVIK	N-----	-VNSVRDWLK	SLKLNLTQQG	LLGTCAKRFK	RWLGIILEAY
PEDV	GGSTWRSFIT	G-----	-LNTMWDFC	RLKVSFGLDG	IVVTVARFKF	RLGALLAEMY
TGEV	YGAIWYNCMP	G-----	-CSDP-SVLG	SQVLLIGNG-	-VKVVCDCGCK	GFAQLSKGY
OV43	GDKYYPVVVD	-DHVGLLDQA	WRVPCAG--R	RVTFEQPTV	KEIISMPKII	KVFYELDNDF
BoCoV	GDKYYPVVVD	-GHVGLLDQA	WRVPCAG--R	CVTFKEQPTV	NEIASTPRTI	KVFYELDKDF
MHV	GDKYYPVVVD	NDTIGVLDQC	WRVPCAG--K	KVEFNDKPKV	KEIPST-RKI	KINFALDATE
AIBV	PPDVVPIKVS	-----	-IECCG--E	PWNTIFKRAY	KEPIEVDL	TVEQLLSVIY
SARS CoV	DKEQYCALSP	--GLLATNNV	FRLKGGAPIK	GVTFG-EDTV	WEVQGY-KNV	RITFELDERV
	905	915	925	935	945	955
EMCR	NGFLETVCVS	VHTAGVCIKY	YAVNVP-YVY	ISGEVSRVIR	RERCD--VTF	PCVSCVTFY
229E	NAFLDTVVST	VKIGGLTFKT	YAFDKP-YIV	IRDIVCKVEN	KTEAEWIELF	PHNDRIKSFS
PEDV	NTYLSTVVEN	LVLAGVSFKY	YATSVP-KIV	LGGCFHSVKS	VFAV--FQI	PVQAGIEKFK
TGEV	NKLCNAARND	IEIGGIPFST	FKTPTNTFIE	MTDAIYSVIE	QGKALS----	-----
OV43	NTILNTACGV	FEVDDTVME	EYAVVIDAI	EELKSPCKEL	EGVGAKVSAP	LQKLEONPLF
BoCoV	NTILNTACGE	FEVDDTVME	EYAVVIDAI	EELKSPCKEL	EGVGAKVSAP	LQKLEONSLF
MHV	DSVLSKACSE	FEVDKDVTD	ELLDDVLDV	ESTLSPCKEH	DVIGTKVCAL	LNRLAEDVYV
AIBV	EKMCDLKL	PEAPEPPPE	NVALVDKNGK	DLDCIKSCHL	IYR-----	-----
SARS CoV	DKVLNEKCSV	YTVESGTEVT	EFACVVAEAV	VKTLPVSDL	LTN---MGID	LDEWSVATFY
	965	975	985	995	1005	1015
EMCR	EFLDTFCGVS	K---PNAID	VEHLEKETE	FVEPKDGGQF	FVSDDYLWYV	V-DDIYYPAS
229E	TFESAYMPIA	D---PTHFD	IEEVELLDAE	FVEPGCGGIL	AVIDEHVYFK	K-DGVVYPSN
PEDV	VFLNCVHPVV	-----PRVIE	TSEVELEET	EKPPALNGGI	AIVDGFAYFY	D-GTLYPTD
TGEV	-FRADVPVV	DNGTISTADW	SEPILLEPAE	YVKKNNGNV	IVIAGTYFYK	DEDEHPYFG
OV43	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESDVEEDDVE	GEETDLTVTS	AGQPCVASEQ
BoCoV	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESGVEEDDVE	GEETDLTVTS	AGEPCVASEQ
MHV	LFDEGEEVI	APKMYCSFSA	P--DDEDCVA	ADVVDADENQ	GDDADDSAAL	VTDTQEEDGV
AIBV	-DYESDDIE	E-----ED-	AECDTDSGE	AECDTNSSEC	EEDEEDTKVL	ALIQDPASIK
SARS CoV	LFDDAGEENF	SSRMVCSFYP	PDEEEDDAE	CEEEIDETC	EHEYGTEDDY	QGLPLEFGAS
	1025	1035	1045	1055	1065	1075
EMCR	CNGVLPVAF	KLGGK--IS	FSDDVIVHDV	EPHVKVLIF	EFE-----	-----DDVVT
229E	GTNLPVAF	KAAGK--VS	FSDDVEVKDI	EPVYRVKLCF	EFE-----	-----DEKLV
PEDV	GNSVVPICFK	KKGGD--VK	FSDEVSVKTI	DPVYKVSLEF	EFE-----	-----SETIM
TGEV	FGKIVQRMYN	KMGGDGKTVS	FSEEDVQEI	APVTRVRLEF	EFD-----	-----NEIVT
OV43	EESSEVLEDT	LDDGPSVETS	OSQVEEDVEM	SDFVLESVI	QD-----	-----YENVCF
BoCoV	EESSEILEDT	LDDGPCVETS	OSQVEEDVQM	SDFGLESVI	QD-----	-----YENVCF
MHV	AKGQGVGAES	DARLDQVEAF	DIEKVEDPIL	NELSAELNAP	ADKTYEDVLA	FDIAYSEALS
AIBV	YPLPLDEDYS	VYNGCIVHKD	ALDVNLPSG	EETFEVNNCF	EG-----	-----AVK
SARS CoV	AETVRVEEEE	EEDWLDDTTE	QSEIEPEPEP	TPEEPVNQFT	CYLK-----	-----LTDNVAI
	1085	1095	1105	1115	1125	1135
EMCR	SLCKK-----	-----S	FGKSIITG-	DWEGLEHVL	SAMNVIG---	---QHILPQF
229E	DVCEK-----	-----A	IGKKIKHEG-	DWDSFCKTIQ	SALSVVS---	---CYVNLPTY
PEDV	AVLNK-----	-----A	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---	---DHVEVPKY
TGEV	GVLER-----	-----A	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL	ANQGLEVEGY
OV43	EFTYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSVLAVMQK	LPCQFKDKNL	QDLWVLYKQ
BoCoV	EFTYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSVLAVMQK	LPCQFKDKNL	QDLWVLYKQ
MHV	AFYAVPGDET	HFVCGFYSP	A--IERTNCW	LRSTLIVMQS	LPLEFKDLEM	QKLWLSYKSS
AIBV	PLPQK-----	-----	---VVDVLG	DWGEAVDAQE	QLCQQEP---	---LQHTFE
SARS CoV	KCVDIVKEAQ	SANPMVIVNA	ANIHLKHGGG	VAGALNKATN	GAMQRESDDY	IKLNGPLTVG
	1145	1155	1165	1175	1185	1195
EMCR	YIYDEEGGYD	VSKP--VMIS	QWPISSDDSG	CVVEASTDFH	Q--LESVREE	VD-----
229E	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE	VNS-----
PEDV	YIYDEEGGTD	PNLP--VMIS	QWPLNDDTIS	QDLLOVEVVT	DAPIDSEGDE	VDSSAFKVA
TGEV	FIYDTCCGGF	IKNPDMGIMIS	QYDINITADE	KSEVSASSE	EE-VESVEED	PENEIVEASE
OV43	YSQLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWRCIKCD	LALK---LKG
BoCoV	YSQLFVDTLV	NKIPANIVVP	QGGYVADFAY	WFLTLCDWQC	VAYWRCIKCD	LALK---LKG
MHV	YNKEFVDKLV	KSVPKSIILP	QGGYVADFAY	FFLSQCSFKA	YANWRCLKCD	MDLK---LQG
AIBV	EPVENSTGSS	KTMTQEVVVE	DQELPVVEQD	QDVVVYPTD	LEVAKETAEE	VD-----
SARS CoV	GSCLLSGHNL	ARKCLHVVG	NLNAGEDIQ	LKAAYENFNS	QDILLAPLLS	AGIFG--AKP

	1205	1215	1225	1235	1245	1255
EMCR	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----	---PFSFSFR
229E	-----	-----	-----IFD	IETVDVKHDV	S-----	---PFEMPFE
PEDV	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV	TKDPFAFDV
TGEV	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQF	NPSLPPFKTT
OV43	LDAMFFYGDV	VSHICKCGES	MVLIDVDVVF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
BoCoV	LDAMFFYGDV	VSHVCKCGES	MVLIDVDVVF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
MHV	LDAMFFYGDV	VSHVCKCGTG	MTLLSADIPY	TLHFGLRDDK	FCAFYTPRKV	FRAACVVDVN
AIBV	-----	-----	-----EFIL	IFAVPKEEVV	S-----	-----QKDG
SARS CoV	LQSLQVCVQT	VRTQVYIAVN	DKALYEQVVM	DYLDNLKPRV	EAPKQEEPPN	TEDSKTEEKS

	1265	1275	1285	1295	1305	1315
EMCR	DELGVRVLQ	SDNNCWIST	LIQLQLTKLL	DDSIEMQLFK	VGVVDSIVQK	CYELSHLISG
229E	ELNGLKILKQ	LDNNCWVNSV	MLQIQLTGIL	DGDYAMQFFK	MGRVAKMIER	CYTAQCIRG
PEDV	SYGGLKVLRLQ	SHNNCWVTST	LVQLQLLGIV	D-DPAMELFS	AGRVGPMVRK	CYESQKAILG
TGEV	NLNGKIILKQ	GDNNCWINAC	CYQLQAFDFF	N-NEAWERFK	RGDVMDVFNL	CYAAATTLARG
OV43	DSHSMVAVDG	KQIDDDHRITS	ITSDKFDFFI	G-HGMSFSMT	TFEIAQLYGS	CITP-NVCFV
BoCoV	DSHSMVAVDG	KQIDDDHRITS	ITSDKFDFFI	G-HGTSFSMT	TFEIAQLYGS	CITP-NVCFV
MHV	DCHSMVAVDG	KQIDGKVVTK	FNGDKYDFMV	G-HGMAFSMS	AFEIAQLYGS	CITP-NVCFV
AIBV	QIKQEPQVQV	KPQREKKAKK	FKVKPATCEK	P-----K-	FLEYKTCVGD	LTVVIAKALD
SARS CoV	VVQRFVDVKP	KIKACIDEVT	TTLEETKFLT	N-KLLLFADI	NGKLYHDSQN	MLRGEDMSFL

	1325	1335	1345	1355	1365	1375
EMCR	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGLC	FWIMPYTKLF	QRGECCICHK
229E	AMGDVGLCMY	RLKDLHTGF	MVMDYKCSCT	SGRLEESGAV	LFCTPTKKA	PYGTCLNCNA
PEDV	SLGDVSACLE	SLTKDLHTLK	ITCSVVCGCG	TGERIYEGCA	FRMTFTLEPF	PYGACAQCAQ
TGEV	HSGDAEYLLS	LMNDYSTAK	IVLAACKCGC	EKEIVLERAV	FKLTPLKESF	NYGVCGDCMQ
OV43	RGDIKIVSKL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
BoCoV	RGDIKIVSKR	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
MHV	RGDVIKVLRR	VGAEEVVNPA	NGRMAHAGAV	AGAIKAAGK	SFIKETADMV	KNOGVQVQGE
AIBV	EKFECFIVNA	ANEHMHGSG	VAKAIADFCG	LDFFEYCEDY	VKKHGPQQR	VTPSFVKGIQ
SARS CoV	EKDAPYVMGD	VITSGDITCV	VIPSKKAGGT	TEMLSRALKK	VPVDEYITTY	PQGGCAGYTL

	1385	1395	1405	1415	1425	1435
EMCR	MQTYKLVSMS	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GVRGSGHYQT	NLYSFDKAID
229E	PRMCTIRQLQ	GTIIIFVQK-	PEPVNPVSFV	VKPVCSISFR	GAVSCGHYQT	NIYSQNLCDV
PEDV	VLMHTFKSIV	GTGIFCRD--	TTALSLSLVS	VKPLCAAFFI	GK-DSGHYVT	NEYDAAMAID
TGEV	VNTRCFLSVE	SGGVFVHDIL	SKQTPPEAMF	VKPVMAHAYT	GTQNGHYMV	DDIEHGYCVD
OV43	CYVSTGGKLC	KTVLNIVGPD	ARTQGGKQSY	LLERVYKHLN	NYDCVVTTLI	SAGIFSVPSP
BoCoV	CYVSTGGKLC	KTVLNIVGPD	ARTQGGKQSY	LLERVYKHLN	KYDCVVTTLI	SAGIFSVPSP
MHV	CYESTGGNLC	KTVLNIVGPD	ARGHGKQCY	FLERAYQHIN	KCDDVVTTLI	SAGIFSVPSP
AIBV	CVNNVVGPRH	GONNLHEKLV	AAYKNVLVDG	VVNVVVPVLS	LGIFGVDFKM	SIDAMREAFE
SARS CoV	EEAKTALKKC	KSAFVLPSE	APNAKEEILG	TVSWNLREML	AHAETTRKLM	PICMDVRAIM

	1445	1455	1465	1475	1485	1495
EMCR	GFGVFDK--	-----	-----NSSV	NTVCFVDVDF	HS-VEIEAGE	VK-----
229E	GFGVFNKQP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP	IKNTVDTTPK
PEDV	GGRHQLK--	-----	-----YDTL	NTICVCKDWN	TAPLVPAVDS	VVEP-----
TGEV	GMGIKPLKKR	CYTSTLFINA	NVMTRAEPK	QEFKVEKVEQ	QPIVEENKSS	IEKEEIQSPK
OV43	VSLTYLLGTA	KQGVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
BoCoV	VSLTYLLGTA	KQGVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
MHV	VSLTYLLGVV	TKNVVLVSNN	KDDFDVIEKC	QVTSIAG-TK	ALSQQLAKNL	CRDVKFETNA
AIBV	GCTIRVLLFS	-----	-----LSQE	HIDYFDVTCK	QKTIYLTEDG	VKYR-----
SARS CoV	ATIQRYKXGI	KIQEGIVDYG	VRFFFTYSKE	PVASIITKLN	SLNEPLVTMP	IGYVTHGFNL

	1505	1515	1525	1535	1545	1555
EMCR	-----	PFAVYKNVKF	YLGDISHLVN	CVSFDFVUNA	ANENLMHGGG	VARAIDILTE
229E	EEFVVKELN	AFLVHDNVAF	YQGDVDTVNV	GVDFDFIVNA	ANENLAHGGG	LAKALDVYTK
PEDV	-----VVK	PFSYKNVDF	YQGDVSDLVK	-LPCDFVUNA	ANEKLSHGGG	IKAIDVYTK
TGEV	ND-----DLIL	PFYKAGKLSF	YQGALDVLIN	FLEPDVIVNA	ANGDLKHMGG	VARAIDVFTG
OV43	NKLILIN---	DVAFVSTFNV	LQDVLSLRHD	IADDDARTF	VQSNVDVVEE	GWRVNVKIFYQ
BoCoV	NKLILIN---	DVAFVSTFNV	LQDVLSLRHD	IADDDARTF	VQSNVDVVEE	GWRVNVKIFYQ
MHV	CDSLFS---	DSCFVSSYDV	LQEVLLRHD	IQLDDARVF	VQAHMDNLPA	DWRLVNFDS
AIBV	-----	-----	-----SIVLKP	DSLQGFQGVY	AKNKIVFTAD	DVEDKEILYV
SARS CoV	EEAARCMR--	SLKAPAVSVS	SSPDVATTYN	GYLTSSSKTS	EEHFVETVSL	AGSYRDWSYS

	1565	1575	1585	1595	1605	1615
EMCR	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFN--VFNVV	GPRTG----	KHEHSLLVEA
229E	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLR--IFNVV	GPRKG----	KHERDLLIKA
PEDV	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLK--VFNVV	GPRKG----	KHAPELLVKA
TGEV	GKLTESKDY	LKKNSIAPG	NAVFFENVIE	HLS--VLNAV	GPRNGD----	SRVEAKLCNV
OV43	INGVRT-VKY	FECTGGIDIC	SQKVFEGYVQ	QGIFNKATVA	QIKALF----	LDKVDILLTV
BoCoV	INGVRT-VKY	FECPGGIDIC	SQKVFEGYVQ	QGSFNKATVA	QIKALF----	LDKVDILLTV
MHV	VDGVRT-VKY	FECPGEIFVS	SQKVFEGYVQ	NGSFKVASVS	QIRALL----	ANKVDVLTCT
AIBV	PTTDSKILEY	YGLDAQKVI	YLQTLAQKWN	VQYRDNFLIL	EWDRGN--CW	ISSAIVLLQA
SARS CoV	GQRTGLGVEF	LKRGDKIVYH	TLESPEVFLH	DG--EVLSD	KLKSLLSLRE	VKTIKVETTV

	1625	1635	1645	1655	1665	1675
EMCR	YNSILFENGI	PLMPLLSGCI	FGVRIENSLK	ALFSCDINKP	LQVFEVYSNE	EQAVLKFLDG
229E	YNTINNEQGT	PLTPILSCGI	FGIKLETSLE	VLLDVCNTKE	VKVEVYTDTE	VCKVRDFVSG
PEDV	YKSVFANSVG	ALTPILSVGI	FSVPLEESLS	AFLACVGDHR	CKCFYGDRE	REAIKYMMDG
TGEV	YKAIACEGK	ILTPILSVGI	FNVRLETSIQ	CLLKTVNDRG	LNVEVYTOQE	RQTENFFS-
OV43	DGVNFTNRFV	PVGESFGKSL	GNVFCDGNNV	TKHKCDINYK	GKVEFFQDNL	SSEDLKAVRS
BoCoV	DGVNFTNRFV	PVGESFGKSL	GNVFCDGNNV	TKHKCDINYK	GKVEFFQDNL	SSEDLKAVRS
MHV	DGVNFRSCCV	AEGEVFGKTL	GSVFCDGINV	TKVRCSAIHK	GKVEFFQYSG	SAADLVAVTD
AIBV	AKIRFKGFLT	EAWAKLLGGD	PTDFVAVCYA	SCTAKVGDFS	DANWLLANLA	EHFDADYTNA
SARS CoV	DNTNLHTQLV	DMSMTYQQQF	GPTYLDGADV	TKIKPHVNHE	GKTFEVLPSD	DTLRSEAFEY

	1685	1695	1705	1715	1725	1735
EMCR	LDLTPVID--	-----DVDV	V-----	--KPRFVEGN	FSFFDCG---	VNALDGD--IY
229E	LVNVQKVE--	-----QPKI	EPKPVSVIKV	APKPYRVDGK	FSYFTEG---	LLCVADDKPI
PEDV	LVDAIFKEAL	VDTPPVQEDV	QQVSQKPVLP	NFEFPRIEGA	HAFYECNPEG	LMSLGAD--KL
TGEV						
OV43	SFNFDQKELL	AYYNMLVN--	CFKWQVNVNG	KYFTFKQANN	NCFVNVSCIM	LQSLHLTFKI
BoCoV	SFNFDQKELL	AYYNMLVN--	CSKWQVNVNG	KYFTFKQANN	NCFVNVSCIM	LQSLNLFKI
MHV	AFGEDEPQLL	KYYNMLG---	MCKWPPVVCG	NYFAFKQSNN	NCYINVACLAM	LQHLNLFKI
AIBV	FLKKRVSCN-	-----	-----	-----	-----	-----
SARS CoV	YHTLDESFLG	RYMSALNH--	TKKWKFQVQG	GLTSIKWADN	NCYLSSVLLA	LQQLVKKFNA

	1745	1755	1765	1775	1785	1795
EMCR	LLFTNSILML	DKQGQL----	LDTKLNGILQ	QAVLDYLATV	KTVPAGNLVK	LVVE--SCTIY
229E	VLFTDSMLTL	DDRGLA----	LONALSGVLS	AAIKDCVDIN	KAIPSGNLIK	FDIG--SVVYV
PEDV	VLFTNSNLDF	CSVGKC----	LNDVTSGLL	EAINVFKKSN	KTVPAGNCVT	LDCANMISIT
TGEV						
OV43	VQWQEAWELEF	RSGRPARFVA	LVLAKGGFKF	GDPADSRDFL	RVVFSQVDLT	GAICDFEAC
BoCoV	VQWQEAWELEF	RSGRPARFVS	LVLAKGGFKF	GDPADSRDFL	RVVFSQVDLT	GAICDFEAC
MHV	VQWQEAWELEF	RSGKPLRFVS	LVLAKGGFKF	NEPSDSTDFM	RVVLRADLS	GATCDFEVC
AIBV						
SARS CoV	PALQEAYYRA	RAGDAANFCA	LILAYSNKTV	GELGOVRETM	THLLQHANLE	SAKRVLNVCV

	1805	1815	1825	1835	1845	1855
EMCR	M-CVVPISND	LSFDKNLGRG	VRKLNRLKTC	VIANVPAIDV	LKKLLSSLTL	TVKFVVSINV
229E	M-CVVPSEKD	KHLNNDVQRC	TRKLNRLMCD	IVCTIPADYI	LPLVLSSLTC	NVSFVGLKA
PEDV	M-VVLPPDGD	ANYDKNYARA	VVKVSKLKGK	LVLAVDDATL	YSKLS--HLS	VLGFVSTPDD
TGEV	--CSIP	-----	-----	-----	-----	-----
OV43	K-CGVKQEQR	TGLDAVMHFG	TLSDRELEIG	YTVDCSCG--	--KKLIHCVR	DVPFLICSNT
BoCoV	K-CGVKQEQR	TGLDAVMHFG	TLSDRELEIG	YTVDCSCG--	--KKLIHCVR	DVPFLICSNT
MHV	K-CGVKQEQR	TGLDAVMHFG	TLSDRELEIG	YTVDCSCG--	--KKLIHCVR	DVPFLICSNT
AIBV	--CGIKSYEL	RGLEACIQP-	-----	-----	-----	-----
SARS CoV	KHCQKQTTTL	TGVEAVMYMG	TLSDYDNLKTG	VSIPCVCGR-	-DATQYLVQQ	ESSFVMSAP

	1865	1875	1885	1895	1905	1915
EMCR	MDVNDCKFND	NVVLKITEDG	INVKDVVVES	SKSLGKQLG-	VVSDGVDSFE	GVLP--INTD
229E	AEA-----K	VITIKVTEG	VNVHDVTVT	DKSFEQQVG-	VIADKDKDLS	GAVPSDLNLS
PEDV	VER--FYANK	SVVIKVTEDT	RSVKAVKVES	TATYGGQIG-	PCLVNDVTVT	DNKP--VVAD
TGEV	--VN-----	-----VTE	VNHERVSVSF	DKTYGEQLKG	TVVIKDKDVT	NQLPSAFDVG
OV43	PASVKLPKG-	VGSANIFIG-	DKVGHYVHVK	CEQSYQLYDA	SNVKKVTDVT	GKLSDCLYLK
BoCoV	PASVKLPKG-	VGSANIFIG-	DKVGHYVHVK	CEQSYQLYDA	SNVKKVTDVT	GKLSDCLYLK
MHV	PEGKLPDD-	VVAANIFTG-	GSGLGHYTHVK	CKPKYQLYDA	CNVSKVSEAK	GNFTDCLYLK
AIBV	-----LLHFK	TQYSNCPCTG	ANNTDEVIEA	SLPYLLLFAT	DGPATVDCDE	DAVG-----
SARS CoV	PAEYKLQGT	FLCANEYTG	YQCGHYTHIT	AKETLYRIDG	AHLTKMSEYK	GPVTDVFPY-K

	1925	1935	1945	1955	1965	1975
EMCR	TVLSVAPEVD	WVAFYGFKA	ALFASLDVVKP	YGYPNDFVGG	FRVLGTDDNN	CWVNATCII
229E	ELLTKAIDVD	WVEFYGFKA	VTFATVDHSA	FAYESAVVNG	IRVLKTSDDN	CWVNATCII
PEDV	VVAKVVPNAN	WDSHYGFKA	GEFHMLDHTG	FTFPSEVVNG	RRVIKTTDDN	CWVNATCII
TGEV	QKVIKADID	WQAHYGFKA	AAFSASSHDA	YKFEVVTHSN	FIVHKQTDNN	CWVNATCII
OV43	NLKTQTFKSVL	TTYLDDVKK	IEYKPDLSQY	YCDGGKYTYQ	RIIKAQFKTF	EKVDGVYTNF
BoCoV	NLKTQTFKSVL	TTYLDDVKK	IEYKPDLSQY	YCDGGKYTYQ	RIIKAQFKTF	EKVDGVYTNF
MHV	NLKTQTFKSVL	TTYLDDVKK	IEYKPDLSQY	YCDGGKYTYQ	RIIKAQFKTF	EKVDGVYTNF
AIBV	TVVEVGSTNS	GHCYTOAAGQ	AFDNLAKDRK	FGKSPYITA	MYTRFAFKNE	TSLPVAKQSK
SARS CoV	ETSYTTTIKP	VSFKLDGVTY	TEIEPKLDGY	YKKNAYYTE	QPIDLVP--TQ	PLPNASFDNF

	1985	1995	2005	2015	2025	2035
EMCR	QYLKPTFKSK	GLNVLWNKFV	TGDOVGPFVVF	IYFITMSSKG	QKGDAAEALS	KLSEYLSIDS
229E	QYSKPHFISQ	GLDAAWNKFV	LGDEIFVAF	VYVVARLMKG	DRGDAEDTLT	KLSEYLSIDS
PEDV	QFARFRFKA	GLQAMWESYC	TGDMVFMVHV	LYWLTGVDKG	QPSDSENALN	MLSKYIVPAG
TGEV	ORLKPQWKF	GVRGLWNEFL	ERKTQGFVHM	LYHISGVKKG	EPGDAELMLH	KLGLMDNDC
OV43	KLIG--HTVC	DSLNAKLGF	SSKEFVEYKI	TEWPTATGDV	VLATODLYVK	RYERGCTIFG
BoCoV	KLIG--HTVC	DSLNAKLGF	SSKEFVEYKI	TEWPTATGDV	VLATODLYVK	RYERGCTIFG
MHV	KLIG--HTVC	DSLNAKLGF	SSKEFVEYKI	TEWPTATGDV	VLATODLYVK	RYERGCTIFG
AIBV	GKSKS--KED	VSNLATSSKA	SFDNLTDFFQ	WYDSNIYESL	KVQSPDNED	KYVSFTTKED
SARS CoV	KLTCSTNKFA	DDLNMQGTGT	KP--ASRELSV	TFFPDNLGNDV	VAIDYRHYS	SFKKGAKLLH

	2045	2055	2065	2075	2085	2095
EMCR	IVTLEQYSTC	DIC-----	-----KSTVV	EVKSAVVCAS	VLKDGCDVG-	-----
229E	QVQLEHYSSC	VECDAKF---	-----KNSVA	SINSAIVCAS	VKRQGVQVG-	-----
PEDV	SVTIERVTHD	GCC-----	-----CSKR	VVTAPVNVAS	VLKLGVEDG-	-----
TGEV	EIIVTHTTAC	DKC-----	-----AKVE	KFVGPPVAAAP	LAIHGTDE--	-----
OV43	KPVIWLSHEK	ASLNSLT---	-----YFNRP	SLVDDNKFDV	LKVDDVD---	-----
BoCoV	KPVIWLSHEQ	ASLNSLT---	-----YFNRP	LLVDENKFDV	LKVDDVD---	-----
MHV	KPVIWLGHEE	ASLNSLT---	-----YFNRP	SVVCENKFNV	LPVDVSEPTD	KGPVPAAVLV
AIBV	SKLPLTLKVR	GIKS-----	-----VV	DFRSKDGFIY	KLTPDPTD--	-----
SARS CoV	KPIVWHINQA	TTKTTFKPNT	WCLRLCWSTK	PVDTNSFEV	LAVEDTGQMD	N-----

	2105	2115	2125	2135	2145	2155
EMCR	----FCPHRH	KLRSRVK---	-----	-----	-FVNGRVVIT	NVGEPIISQP
229E	----YCVHGI	KYYSRVR---	-----	-----	-SVRGRAIIV	SVEQLEPCAQ
PEDV	----LCPHGL	NYIGKVV---	-----	-----	-VVGKTTIVV	NVGKPPVAPS
TGEV	----TCVHGV	SVNVKVT---	-----	-----	-QIKGTVAIT	SLIGPIIG--
OV43	----DGGDSS	ESGAKE---	-----	-----	TKEINIIKLS	GVKKPFKVED
BoCoV	----DGGDIS	ESDAKE---	-----	-----	PKEINIIKLS	GVKKPFKVED
MHV	TGALSGAATA	PGTAKEQKVC	ASDSVVDQVV	SGFLSDLSGA	TVDVKEVKLN	GVKKPIKVED
AIBV	-----	-----	-----	-----	--ENSKAPVY	YPVLDAISLK
SARS CoV	----LACESQ	QPTSEEVVEN	-----	-----	-PTIQKEVIE	CDVRTTEVVG

	2165	2175	2185	2195	2205	2215
EMCR	SKLLNGIAYT	TFS--GSFDN	GHYVVYDAAN	NAVYDGARLF	ASDLSTLAVT	AIVVVGGCVT
229E	SRLLSGVAYT	AFS--GPVDR	GHYTVYDTAK	KSMYDGDREY	KHDLSSLSVT	SVVMVGGYVA
PEDV	HLFLKGVSYT	TFLDNGNGVV	GHYTVFDHGT	GMVHDGDAEF	PGDLNVSPVT	NVVVSEQTAV
TGEV	-EVLEATGYI	CYS--GSNRN	GHYTYDNRN	GLVVDAEKAY	HFNRDOLLQVT	TAIASNFVVK
OV43	SVIVNDTSE	TRYVKSLSIV	DVYDMWLTGC	KYVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
BoCoV	SVIVNDTSE	IKYVKSLSIV	DVYDMWLTGC	RCVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
MHV	SVVNDPTSE	TKVVKLSIV	DVYDMWLTGC	RYVVMANEL	SRLVNSPTVR	EYVKKWGMTKI
AIBV	AIWVEGNANF	VVG-----	HP NYYSKSLHIP	TFWENAENFV	KMGDKIGGVT	MGLWRAEHLN
SARS CoV	NVILKPSDEG	VKVTQELGHE	DLMAAYVENT	SITIKKPNEI	SLALGLKTTA	THGIAAINS

	2225	2235	2245	2255	2265	2275
EMCR	S-----	-----NVPP	IVSEKISVMD	KLDTG---AQ	KFFQFGDFVM	NNIVLFLTWL
229E	-----	-----PV	NTVKPKPVIN	QLDEK---AQ	KFFDFGDFLI	HNFIFFTWL
PEDV	V-----	-----IKDP	VKKAELDATK	LLDTMNYASE	RFFSFGDFMS	RNLITVFLYI
TGEV	KPQAEERPKN	CAFNKVAAAP	KIVQEQKLLA	IESGANYALT	EFGRYADMFF	MAGDKILRL
OV43	SIP-----	-----IDLL	NLREIKPAVN	VVKAVRNKIS	VCNFIKWLF	VLLFGWIKIS
BoCoV	SIP-----	-----IDLL	NLREIKPVFN	VVKAVRNKIS	ACNFIKWLF	VLLFGWIKIS
MHV	VIP-----	-----AKLV	LLRDEKQEFV	APKVVKAKVI	ACYSAVKWFF	LYCFSWIKFN
AIBV	KPN-----	-----LERI	FNIAKKAIVG	SSVVTTCQCK	LIGKAATFIA	DKVGGGVVRN
SARS CoV	PWS-----	-----KILA	YVKPFLG---	--QAAITTSN	CAKRLAQRVF	NNYMPYVFTL

	2285	2295	2305	2315	2325	2335
EMCR	LSMFSLLRTS	IMKHDIKIVA	KAPKRTGVIL	TRSFYKNIRS	ALFVVQKQWC	VIVTLFKFLL
229E	LSMTLCKTA	VTTGDVKIMA	KAPQRTGVVL	KRSLKYNLKA	SAAVLKSQWV	LLAKFTKLLL
PEDV	LSILGLCFRA	FRKRDVKVLA	GVPQRTGIIL	RKSMRYNAKA	LGVEFFKLKLY	WFKVLGKFSL
TGEV	LEVFKYLLVL	FMCLRSTKMP	KVKVKP-PLA	FKDFGAKVRT	LNVMRQLNKP	SVWRYAKLVL
OV43	ADNKVIYITE	IASKLTCKLV	ALAFKNAFLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
BoCoV	ADNKVIYITE	VASKLTCKLV	ALAFKNAFLT	FKWSVVARGA	CIIATIFLLW	FNFIYANVIF
MHV	TDNKVIYITE	VASKLTENLC	CLAFKNAFLT	FNWVVSRGF	FLVATVFLW	FNFIYANVIL
AIBV	ITDSIKGLCG	ITRGHFERKM	SPOFLKTLMF	FLFYFLKASV	KSVVASYKTV	LCKVVLATLL
SARS CoV	LFQLCTFTKS	TNSRIRASLP	TTIAKNSVKS	VAKLCLDAGI	NYVKSPPKFSK	LFTIAMWLLL

	2345	2355	2365	2375	2385	2395
EMCR	LLYAIYALVF	MIVQFSPFNS	LLCGDIVSGY	EKSTFN---	--KDIYCGNS	MVCKMCLFSY
229E	LIYTLYSVVL	LCVRFPGPFN	-FCSETVNGY	AKSNFV---	--KDDYCDGS	LGCKMCLFGY
PEDV	GIYALYALLF	MTIRFTPIGS	PVCDDVAGY	ANSSFD---	--KNEYCN-S	VICKVCLYGY
TGEV	LLIAIYNFFY	LFVSI PVVHK	LTCNGAVQAY	KNSSFI---	--KSAYCGNS	ILCKACLASY
OV43	SDFYLPKIGF	LPTFVGKIAQ	WIKNTFSLVT	ICOLYSMDQV	GFKNQYCNCS	IACQFCLAGF
BoCoV	SDFYLPKIGF	LPTFVGKIVQ	WIKNTFSLVT	ICOLYSIQDV	GFKNQYCNCS	IACQFCLAGF
MHV	SDFYLPNIGF	FPTFVGQIVA	WVKTTFGIFT	LCOLYQVSDV	GYSRSPCNCS	MVCELCFSGF
AIBV	IWVFTVTSNP	VMFTGIRVLD	FLFEGSLCGP	YKDYGK--DS	FDVLRVCADD	FICRVCLHDK
SARS CoV	LSICLGSLIC	VTAAGFVLLS	NFGAPSYCNG	VRELYLNSSN	VTTMDFCEGS	FPCSICLSGL

	2405	2415	2425	2435	2445	2455
EMCR	QEFNOLDHTS	LWVKHIR---	-----D--P--	-ILISLQPFV	ILVILLIFGN	MYLRFGLLYF
229E	QELSQFSHLD	VWVKHIT---	-----D--P--	-LFSNMQPFV	VMVLLIFGD	NYLRCFLLYF
PEDV	QELSDFSHTQ	VWQHLR---	-----D--P--	-LIGNVMPFF	YLAFLAIFGG	VYVKAITLYF
TGEV	DELADFOHLQ	VTWDFKS---	-----D--P--	-LWNRLVQLS	YFAFLAVFGN	NYVRCFLMYF
OV43	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTTW
BoCoV	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTTW
MHV	DMLDNYDAIN	VVQYVDDRRV	SFDYISLFKL	VVELIVGYSL	YTVCFYPLFG	LIGMQLLTTW
AIBV	DSLHLYKHAY	SVEQVYKDA	SG-----	--FIFNWNWL	YLVFLILFVK	PVAGFVLIIC
SARS CoV	DSLDSYPAL	TIQVTS--S	YKLDLTILGL	AAEWVLAJML	FTKFFYLLGL	SAIMQVFFGY

	2465	2475	2485	2495	2505	2515
EMCR	VAQFISTFG-	-SFLGFHQKQ	WFLHFVPFDV	LCNEFLATFI	VCKIVLFVRH	IIVGCNNADC
229E	VAQMISTVG-	-VELGYKETN	WFLHFIPFDV	ICDELLVTVI	VIXVISFVRH	VLFGCENPDC
PEDV	IFQYLNSLG-	-VFLGLQOQSI	WFLQLVPFDV	FGDEIVVFFI	VTRVLMFIKH	VCLGCDKASC
TGEV	VSQYLNHLW-	-SYFGYVEYS	WFLHVVNFES	ISAEFVIVVI	VVKAVLALKH	IVFACSNPSC
OV43	LPELFMLST-	-LHWSFRLLV	ALANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
BoCoV	LPELLMLST-	-LHWSVRLLV	SLANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
MHV	LPEFFMLET-	-MHWSARFFV	FVANMLPAFT	LLRFYIVVTA	MYKIFCLCRH	VMYGCSPGCG
AIBV	CVKYLVLNST	VLQTVGCFD	WVQTVFSHF	NFMGAGFYFW	LFYKIYIQVH	HILYCKDVTC
SARS CoV	FASHFISN--	--SWLMWFII	SIVQMAPVSA	MVRMYIFFAS	FYYIWKSYVH	IMDGCTSSTC

	2525	2535	2545	2555	2565	2575
EMCR	VACSKSARLK	RVPLQTIING	MHKSFYVNAV	GGTCFCNKHN	FFCVNCDSFG	PGNTFINGDI
229E	IACSKSARLK	RFPVNTIING	VQRSFYVNAV	GGSKFCCKHR	FFCVDCDSYG	YGSTFITPEV
PEDV	VACSKSARLK	RVPVQTIQO	TSKSFYVNAV	GGSKFCCKHN	FFCLNCDSYG	PGCTFINDOI
TGEV	KTCSTARQT	RIPIQVVVNG	SMKTVYVNAV	GTGKFCCKHN	FYCKNCDSYG	FENTFICDEI
OV43	LFCYKRNRL	RVKCSTIVGG	MIRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
BoCoV	LFCYKRNRL	RVKCSTIVGG	MIRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
MHV	LFCYKRNRL	RVKCSTIVGG	TLRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
AIBV	EVCKRVARSN	RQEVSVVGG	RKQIVHVYTN	SGYNFCCKHN	WYCRNCDDYD	HQNTFMSPEV
SARS CoV	MMCYKRNRL	RVECTIIVNG	MKRSFYVNAV	GGRGFCCKHN	WNCIDCDSYK	TGSTFISDEV

	2585	2595	2605	2615	2625	2635
EMCR	ARELGNVVK	AVQPTAPAYV	IIDKVDVFN	FYRLYSGDTF	WRYDFDITES	KYSCKE----
229E	SRELGNITKT	NVQPTGPAYV	MIDKVEFENG	FYRLYSCETF	WRYNFDITES	KYSCKE----
PEDV	ATEVGNVVK	NVQPTGPATI	LIDKVEFSNG	FYRLYSGDTF	WRYNFDITDS	KYTCKE----
TGEV	VRDLNSVVK	TVYATDRSHQ	EVTKEVCSDG	FYRFYVGGDEF	TSYDYDVKHK	KYSCKE----
OV43	ALDLSKELKR	PIQPTDVAYH	TVDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
BoCoV	ALDLSKELKR	PIQPTDVAYH	TVDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
MHV	AADLSKELKR	PVNPTDSAYY	LTVTEVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDMNGLLH
AIBV	AGELSEKLR	HVKPTAYAYH	VVDEACLVD	FVNLKYKAAT	PGKDSASSAV	KCFSVTDFLK
SARS CoV	ARDLSLQFKR	PINPTDQSSY	IVDSVAVKNG	ALHLYFDKAG	KQTYERHPLS	HFVNLNLR

	2645	2655	2665	2675	2685	2695
EMCR	-VLKNCNVLE	NFIVVNN--	-----SGSNI	TQIKNACVYF	SQLLCEPIKL	VNSSELLSTLS
229E	-VFKNCNVLD	DFIVFNN--	-----NGTNV	TQVKNASVYF	SQLLCRPIKL	VDSSELLSTLS
PEDV	-ALKNCSIIIT	DFIVFNN--	-----NGSNV	NQVKNACVYF	SQMLCKPVKL	VDSALLASLS
TGEV	-VLKSMALLD	DFIVVSP--	-----SGSAL	ANVRNACVYF	SQILGKPIKI	VNSDLELDS
OV43	SKVKSVPNMH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VOKNLITTAN
BoCoV	SKVKSVPNMH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VOKNLITTAN
MHV	SKVKGVPETH	VVVVEN----	-----EADK	AGFLNAAVFY	AQSLYRPMIL	VEKKLITTAN
AIBV	KAVFLKEALK	CEQISNDGFI	VCNTQSAHAL	EEAKNAATY	AQYLCKPILI	LQDALYEQLV
SARS CoV	NNTKGSLPIN	VIVFDGK--	-----SKCDE	SASKSASVY	SQLMCQPILL	LQQVLVSDVG

	2705	2715	2725	2735	2745	2755
EMCR	--VDFNGVLH	KAYVDVLCNS	FFKELTANMS	MAECKATLGL	T-----	-----
229E	--VDFNGVLH	KAYIDVLRNS	FGKDLNANMS	LAECKRALGL	S-----	-----
PEDV	--VDFGASLH	SAFVSVLNS	FGKDLSSCND	MQDCKSTLGF	DD-----	-----
TGEV	--VDFKGALF	NAKKNVIKNS	FNVDSVECKN	LDECYRACNL	N-----	-----
OV43	TGTSVTETMF	DVYVDTFLSM	FDVOKKSLNA	LIATAHSSIK	QGTQIYKVL	TFLSCARKSC
BoCoV	TGTSVTETMF	DVYVDTFLSM	FDVOKKSLNA	LIATAHSSIK	QGTQICKVL	TFLSCARKSC
MHV	TGLSVSQTMF	DLYVDSLGLV	LDVDRKSLTS	FVNAHNSLK	EGVQLEQVMD	TFIGCARRKC
AIBV	V-EPVSKSVI	DKVCSILSSI	ISVDTAALNY	KAGTLRDALL	S-----	-----
SARS CoV	DSTEVSVMKF	DAYVDTFSAT	FVPMKELKA	LVATAHSELA	KGVALDGVLS	TFVSAARQGG

	2765	2775	2785	2795	2805	2815
EMCR	-----VSDDD	FVSANVAHR	YDVLLSDLSF	NNFFISYAKP	EDK-LSVYDI	ACCMRAGSKV
229E	-----ISDHE	FTSAISNAHR	CDVLLSDLSF	NNFVSSYAKP	EEL-LSAYDI	ACCMRAGAKV
PEDV	-----VPLDT	FNAVAEAEHR	YDVLLTDMSF	NNFTTSYAKP	EEL-FPVHDI	ATCMRVGAKI
TGEV	-----VSFST	FEMAVNNAHR	EGILITDRSF	NNFWPSKVVP	GSSGVSAMDI	GKCMTSDAKI
OV43	SIDSVDVTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
BoCoV	SIDSVDVTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKG	DN--IVAADL	GVLIQNSAKH
MHV	AIDSVDVTKS	ITKSIMSAVN	AGVDFDESC	NNLVPTYVKS	DT--IVAADL	GVLIQNSAKH
AIBV	-----ITKDEE	AVDMAIFCHN	HDVDYTGDF	TNVPISYDID	TG-KLTPRDR	GFLINADASI
SARS CoV	VVDVDTDKD	VIECKLSHH	SDLEVTGDS	NNFMTLYNKV	EN--MTPRDL	GACIDCNARH

	2825	2835	2845	2855	2865	2875
EMCR	VNNHVLKES	IPVWGVKDF	NLSQEGKKY	LVKTTKAKGL	TFLLTNDNQ	AITQVP----
229E	VNANVLTKDQ	TPVWVHAKDF	NLSAEGKKY	IVKTSKAKGL	TFLLTINENQ	AVTQIP----
PEDV	VNNHVLKDS	IPVWVLRDF	IALSEETRY	IIRTTKVKGI	TFMLTFNDCR	MHTTIP----
TGEV	VNAKVLTRG	KSVVWLSQDF	AALSSTAQV	LVKTFVEGV	NFSLTFNAV	SDDDLPIYERF
OV43	VQGNVAKIAG	VSCIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSFLT---
BoCoV	VQGNVAKIAG	VSCIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSFLT---
MHV	VQANVAKAAN	VACIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KIKLTYNKQE	ANVPILT---
AIBV	ANLRVKN--A	PPVWVKFSEL	IKLSDSLCKY	LISATVRSKV	RFFITKSGAK	QVIACHT---
SARS CoV	INAQVAKSHN	VSLIWNVKDY	MSLSEQLRQ	IRSAARKNNI	PFRLTCATTR	QVNVNIT---

	2885	2895	2905	2915	2925	2935
EMCR	ATSIKAKQGA	G-----	--FKRTYNFL	WYVCLFVVAL	FIGVSFID--	---YTTTITS
229E	ATSIKAKQGA	GD-----	--AGHSLTWL	WLLCGLVCLI	QFYLCFPMFY	--FMYDIVSS
PEDV	TVCIANRKG	GLPS-----	--FSKVKKFF	WFLCLFIVAA	FFALSFLD--	---FSTQVSS
TGEV	TESVSPKSGS	G-----	--FFDVITQL	KQIVILVFEV	IFICGLCSVY	SVATQSYIES
OV43	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHRSDFQL
BoCoV	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHRSDFQL
MHV	--TPFSLKGG	A--V-----	--FSKVLQWL	FVNLICFIV	---LWALMPT	YAVHKSMDQL
AIBV	QKLLVEKKAG	GIVSGTFKCF	RSYFKWLLIF	YILFTACCSG	YYYMEVSKSF	VHPMYDVNST
SARS CoV	--TKISLKGG	K--I-----	--VSTCFKLM	LKATLLCVLA	ALVCYIVMPV	HTLSIHGTYT
	2945	2955	2965	2975	2985	2995
EMCR	FHGYDFRYIE	NGQLKVFEAP	LHCVRNVFDN	FNQWHEAKFG	VVTTNSDKCP	IVVG----VS
229E	FEGYDFRYIE	NGQLKNFEAP	LKCVNRNVFEN	FEDWHYAKFG	FTPLNKQSCP	IVVG----VS
PEDV	DSYDFRYIE	SGQLKTFDNP	LSCVHNVFIN	FDQWHDARFG	FTPNNPSCP	IVVG----VS
TGEV	AEGYDYMKV	NGIVQPFDDT	ISCVHNTYKG	FGDWFKAKYG	FIPTFGKSCP	IVVGT--VFDL
OV43	PVYASYKVL	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VIDQ
BoCoV	PVYASYKVL	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VVDQ
MHV	PLYASFVID	NGVLRDVTVT	DACFANKFIQ	FDQWYESTFG	LVYYRNSRAC	PVVVA-VIDQ
AIBV	LHVEGFKVID	KGVLREIVPE	DTCFSNKEVN	FDQWYESTFG	NSRNCPIVTA	VIDGDGTAT
SARS CoV	NEIIGYKAIQ	DGVTRDIIST	DDCFANKHAG	FDQWYESTFG	S--YKNDKSC	PVVAA-IITR
	3005	3015	3025	3035	3045	3055
EMCR	ERINVPVGP	TVVYLVG---	-KTLVFTLQA	AFGNTGVCYD	FDGVTTS---	--DKCIFNSA
229E	EIVNTVAGIP	SNVYLVG---	-KTLIFTLQA	AFGNAGVCYD	IFGVTTT---	--EKCIPTSA
PEDV	DEARTVPGIP	AGVYLAG---	-KTLVFAINT	IFGTSGLCFD	ASGVADK---	--GACIFNSA
TGEV	ENMRPIPDV	AYVSIYG---	-RSLVFAINA	AFGVTNMCYD	HTGNAVSKDS	YFDTVCVNTA
OV43	DFGSTVFNP	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
BoCoV	DFGSTVFNP	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
MHV	DIGYTLFNP	TKVLRYG---	FHVLHFITHA	FATDSVQCYT	PHMQIPYDNF	YASGCVLSSL
AIBV	GVPGFVSWM	DGVMEIHMTQ	TERKWPYIPT	WFNRIVGYT	QDSIITEGSF	YTSIALFSAR
SARS CoV	EIGFIVPGLP	GTVLRAIN--	GDFLHFLPRV	FSAVGNICYT	PSKLEIYSDF	ATSACVLAAE
	3065	3075	3085	3095	3105	3115
EMCR	CTRLEGLGGD	-NVYCYNTDL	IEGSKPYISL	QPNAYYKYDV	K-NYVRFPEI	LARGFGLRTI
229E	CTRLEGLGGN	-NVYCYNTAL	MEGSLPYSSI	QANAYYKYDN	G-NFIKLPEV	IAQGFGEFTY
PEDV	CTTSLGLGGT	-AVYCYKNGL	VEGAKLYSEL	APHSYKMYDV	G-NAVSLPEI	ISRGFGIRTI
TGEV	CTTTLGLGGT	-IVYCAKQGL	VEGAKLYSDL	MPDYIYEHAS	G-NMVKLPAL	IR-GLGLRFV
OV43	CTMTMADGS	PQPYCYTEGL	MQNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
BoCoV	CTMFAMADGS	PQPYCYTDGL	MQNASLYSSL	VPHVRYNLAN	AKGFIRLPEV	LREGL-VRIV
MHV	CTMLAHADGT	PHPYCYTEGI	MNASLYDSSL	APHVRYNLAN	SNGYIRFPEV	VSEGI-VRIV
AIBV	CLYLTASNT	QLYCFNGDND	APGALPFGSI	IPHRVYFQPN	GVRLIVPQOI	LHTPY----VV
SARS CoV	CTIFKDAMGK	PVPYCYDTNL	LEGSISYSEL	RPDTRYVLMG	G-SIIQFPNT	YLEGS-VRVV
	3125	3135	3145	3155	3165	3175
EMCR	RTLATRYCRV	GECRDSHKG	CFGFDKXWVN	DGRVD---DG	YICGDGLIDL	LVNVLISFSS
229E	RTIATKYCRV	GECVESNAGV	CFGFDKWEVN	DGRVA---NG	YVCGTGLWNL	VFNILSMFSS
PEDV	RTKAMTYCRV	GQCVQSAEGV	CFGADRFFVY	NAESG---SD	FVCGTGLFTL	LMNVISVFSK
TGEV	KTQATYCRV	GECIDSKAGF	CFGGDNWFVY	DNEFG---NG	YICGNSVLGF	FKNVFKLFNS
OV43	RTRMSYCRV	GLCEEADDEGI	CFNFNGSWVL	NNDYYSRLPG	TFCGRDVFOL	IYQLFKGLAQ
BoCoV	RTRMSYCRV	GLCEEADDEGI	CFNFNGSWVL	NNDYYSRLPG	TFCGRDVFOL	IYQLFKGLAQ
MHV	RTRMSYCRV	GLCEDAEDEGV	CFNFNSWVL	NNPYRRAMP	TFCGRNADFOL	IHQVLGLLVR
AIBV	KFVSOSYCRG	SVCEYTRPGY	CVSLNPQWVL	FNDYTSKPG	VFCGSTVREL	MFSMVSTFTT
SARS CoV	TTFDAEYCRH	GTCESEVGI	CLSTSGRWVL	NNEHYRALSG	VFCGVDMANL	IANTFTPLVQ
	3185	3195	3205	3215	3225	3235
EMCR	SFSVAMSGH	MLFNELFAAF	ITFLCFLVTK	FKRVFGDLSY	GVFTVVCATL	INNISYVVTO
229E	SFSVAMSGQ	ILLNCALGAF	AIFCCFLVTK	FRRMFGDLSV	GVCTVVAVL	LNNVSYIVTO
PEDV	TVPVTVLSGQ	ILFNCTIAFV	AVAVCFLETK	FKRMFGDMSV	GVFTVGACTL	LNNVSYIVTO
TGEV	NMSVATSGA	MLVNIIIAEL	AIAMCYGVLK	FKRIFGDCFT	LIVMIIITLV	VNNVSYFVTO
OV43	PVDFALTAS	SIAGAILAVI	VVLVFFYLK	LKRAFGDYTS	VVFVNIVVWC	VNFMMLEVFQ
BoCoV	PVDFALTAS	SIAGAILAVI	VVLGFFYLK	LKRAFGDYTS	IVFVNIVVWC	VNFMMLEVFQ
MHV	PIDFFALTAS	SVAGAILAVI	VVLAFYLLK	LKRAFGDYTS	VVFVNIVVWC	VNFMMLEVFQ
AIBV	GVN-PNIMQ	LATMFLILVV	VVLIFAMVIK	FQGVFKAYAT	TVFITHLVVW	INAFILCVHS
SARS CoV	PVGALDVSAS	VVAGGIIAIL	VTCAYYFEMK	FRRVFGEYNH	VVAANALLFL	MSFTILCLVP
	3245	3255	3265	3275	3285	3295
EMCR	N-LFFMLLYA	ILYFVFTRTV	R--YAWIWHI	AYIVAYFLLI	PWWLLTWFSF	AAFLELLPNV
229E	N-LVTMIAYA	ILYFFATRSI	R--YAWIWCA	AYLIAYISFA	PWWLCAWYFL	AMLTGLLPSL
PEDV	N-TLGMGLYA	TLYFLCTKGV	R--YMWIWHL	GFLISYILIA	PWWVLMVYAF	SAIFEFPNPL
TGEV	N-TLGMIIYA	IVYFFITRKL	A--YPGILDA	GFLIAYINMA	PWYVITAYIL	VFLYDLSPLS
OV43	VYPTLSCVYA	ICFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIA	VVVSNNHAFV
BoCoV	VYPTLSCVYA	ICFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIS	VVVSNNHAFV
MHV	VYPTLSCVYA	CFYFYTTLYF	PSEISVIMHL	QWLVMYGAIM	PLWFCIIYVA	VVVSNNHALWL
AIBV	YNSVLAVILL	VLYCYASLVT	SRNTVIIMHC	WLVTFTGLIV	PTWLACCYLG	FIIYMYTPLF
SARS CoV	AYSFLPGVYS	VFYLYLTFYF	TNDVSFLAHL	QWFAMFSPIV	PFWITAIYVF	CISLKHCHWF

	3305	3315	3325	3335	3345	3355
EMCR	FKLKISTQ--	--LFEGDKFI	GTFFSAAAGT	FVLDMRSYER	LINT--ISPE	KLKNYAASYN
229E	LKLKVSTN--	--LFEGDKFV	GTFFSAAAGT	FVIDMRSYER	LANS--ISPE	KLKSYAASYN
PEDV	FKLKVSTQ--	--LFEGDKFV	GSFENAAAGT	FVIDMHAYER	LANS--ISTE	KLRQYASTYN
TGEV	FKLKVSTN--	--LFEGDKFV	GNFESAAMGT	FVIDMRSYET	IVNS--TSIA	RIKSYANSFN
OV43	FSYCRKLG--	--TSVR--SD	GTFFEMALT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
BoCoV	FSYCRKLG--	--TSVR--SD	GTFFEMALT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
MHV	FSYCRKLG--	--TEVR--SD	GTFFEMSLTT	FMITKESYCK	LKNS--VSDV	AFNRYLSLYN
AIBV	LWCYGTNT	RKLYDGNFV	GNYDLAAKST	FVIRGSEFVK	LTNE---IGD	KFEAYLSAYA
SARS CoV	FNNYLRKR--	--VMFNGVTF	STFEAAALCT	FLNKMELYK	LRSETLLPLT	QYNRYLALYN

	3365	3375	3385	3395	3405	3415
EMCR	KYKYSGSAS	EADYRCACYA	HLAKAMLDYA	-KDHNMLYS	PPTISYN-ST	LQSGLKMAQ
229E	RYKYYSGNAN	EADYRCACYA	YLAKAMLDYS	-RDHNDILYT	PPTVSYG-ST	LQAGLRKMAQ
PEDV	KYKYSGSAS	EADYRLACFA	HLAKAMMDYA	-SNHNDTLYT	PPTVSYN-ST	LQAGLRKMAQ
TGEV	KYKYTGSMG	EADYRMACYA	HLGKALMDYS	-VNRTDMLYT	PPTVSVN-ST	LQSGLRKMAQ
OV43	KYRYSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMYN
BoCoV	KYRYSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMYN
MHV	KYRYFSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMYN
AIBV	RLKYYSGTGS	EQDYLQACRA	WLAYALDQYR	-NSGVEIVYT	PPRYSIGVSR	LQSGFKKLVF
SARS CoV	KYKYFSGALD	TTSYREAACC	HLAKALNDYS	-NSGADVLYQ	PPQTSITSAT	LQSGFKKMAF

	3425	3435	3445	3455	3465	3475
EMCR	PSGCVERCVV	RVCYGSTVLN	GVWLGDTVTC	PRHVIAPSTT	VL-IDYDHAY	STMRLHNFVS
229E	PSGFVEKCVV	RVCYGNVTLN	GLWLGDIYVC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFVS
PEDV	PSGVVEKCVV	RVCYGNMMLN	GLWLGDIYVC	PRHVIASSTT	ST-IDYDYAL	SIVRLHNFVS
TGEV	PSGLVEPCIV	RVSYGNNVLN	GLWLGDEVIC	PRHVIASDTT	RV-INYENEM	SSVRLHNFVS
OV43	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSTDTV
BoCoV	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSTDTV
MHV	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVVYC	PRHVICSSAD	MTDPOYSNLL	CRVISSDFCV
AIBV	PSSAVEKCVV	SVSYGNMMLN	GLWLGDTIYC	PRHVLGKFSG	DQ---WINDVL	MLANNHEFEV
SARS CoV	PSGKVEGCMV	QVTCGTTTLN	GLWLDOTVYC	PRHVICTAED	MLNPNYEDLL	IRKSNHNSFLV

	3485	3495	3505	3515	3525	3535
EMCR	SHNG-VFLGV	VGVTMHGSVL	RIKVSQSNVH	TPKHVFETLK	PGASFNILAC	YEGIASGVFG
229E	ISGT-AFLGV	VGATMHGVTL	KIKVSQTNMH	TPRHSFRTLK	SSEGFFNILAC	YDCAQGVFG
PEDV	SSGN-VFLGV	VSATMRGALL	QIKVNQNNVH	TPKYTYRTVR	PGESFNILAC	YDCAAGVYV
TGEV	SKNN-VFLGV	VSARYKGVNL	VLKVNQNNPN	TPEHKFSIK	AGESFNILAC	YEGCPGVSFG
OV43	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
BoCoV	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
MHV	MSGR-MSLTV	MSYQMQGSL	VLTVTLQNP	TPKYSFGVVK	PGETFTVLAA	YNGKSQGAH
AIBV	TTQHGVTNLV	VSRRLKGAVL	ILQTAVANAE	TPKYKFIKAN	CGDSFTIACA	YGGTVVGLYP
SARS CoV	QAGN-VQLRV	IGHSMQNCLL	RLKVDTSNPK	TPKYKFEVRIQ	PGQTFSVLAC	YNGSPSGVYQ

	3545	3555	3565	3575	3585	3595
EMCR	VNLRTNFETIK	GSFINGACGS	PGYNVRNDGT	VEFCYLHQIE	LGSAGHVGSD	FTGSVYGNFD
229E	VNMRTNWTIR	GSFINGACGS	PGYNLKN-GE	VEFVYMHQIE	LGSAGHVGSD	FDGVMYGGFE
PEDV	VNMRSNYTIR	GSFINGACGS	PGYNINN-GT	VEFCYLHQIE	LGSAGHVGSD	LDGVMYGGFE
TGEV	VNMRSQGTIK	GSFIAGTCGS	VGYYLEN-GI	LYFVYMHQIE	LGSAGHVGSD	FEFEGMYGGFE
OV43	VTMRSSTYTIK	GSFLCGSCGS	VGYYVIMG-DC	VKEFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
BoCoV	VTMRSSTYTIK	GSFLCGSCGS	VGYYVIMG-DC	VKEFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
MHV	VTMRSSTYTIK	GSFLCGSCGS	VGYYVLTG-DS	VRFVYMHQIE	LSTGCHTGT	FSGNFGPYR
AIBV	VTMRSNGTIR	ASFLAGACGS	VGFNIEK-GV	VNFFVYMHQIE	LPNALHTGT	LMGEFYGGYV
SARS CoV	CAMRNHTIK	GSFLNGSCGS	VGFNIDY-DC	VSEFCYMHQIE	LPTGVHAGTD	LEGKFYGPV

	3605	3615	3625	3635	3645	3655
EMCR	DQPSLQVESA	NMLSDNVVA	FLYAALLNGC	R-----WWL	RSTRVNVDFG	NEWAMANGYT
229E	DQPNLQVESA	NQMLTVNVVA	FLYAAILNGC	T-----WWL	KGEKLFVEHY	NEWAQANGFT
PEDV	DQPTLQVEGA	SSLFTENVLA	FLYAALINGS	T-----WWL	SSSRIAVDRF	NEWAVHNGMT
TGEV	DQPSMQLEGT	NVMSSDNVVA	FLYAALINGE	R-----WVW	TNTSMSLESY	NTWAKTNSFT
OV43	DAQVVLQIQ	DYIQSVNFVA	WLYAAILNNC	N-----WVW	QSDKCSVEDE	NVWALSNGFS
BoCoV	DAQVVLQPVQ	DYIQSVNFVA	WLYAAILNNC	N-----WVW	QSDKCSVEDE	NVWALSNGFS
MHV	DAQVVLQPVQ	DYIQSVNFVA	WLYAAILNRC	N-----WVW	QSDKCSLEEF	NVWAMTNGFS
AIBV	DEEVAQRVPP	DNLVTNNIVA	WLYAAIISVK	ESSFSLPKWL	ESTTVSVDDY	NKWAGDNGFT
SARS CoV	DRQTAQAAGT	DTTITLNVLA	WLYAAVINGD	R-----WFL	NRFTTTLNDF	NLVAMKYNYE

	3665	3675	3685	3695	3705	3715
EMCR	IVSSVECC--Y	SILAARTGVS	VEQLLASIQH	LHE-GFGGKN	ILGYSSLCDE	FTLAEEVVKQM
229E	AMNGEDA--F	SILAARTGVC	VERLLHAIQV	LNN-GFGGKQ	ILGYSSLNDE	FSINEVVKQM
PEDV	TGNTTDC--F	SILAARTGVD	VORLLASIQS	LHK-NFGGKQ	ILGHTSLTDE	FTTGEVVRQM
TGEV	ELSSDA--F	SMLAARTGQS	VEKLLDSIVR	LNK-GFGGRT	ILSYGSLCDE	FTPTTEVIRQM
OV43	QVKSDELV--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFED	LTPSDVYQQL
BoCoV	QVKSDELV--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFED	LTPSDVYQQL
MHV	SIKADLV--L	DALASMTGVT	VEQILAAIKR	LYS-GFQGRQ	ILGSCVLEDE	LTPSDVYQQL
AIBV	PFSTSTA--I	TKLSAITGVD	VCKLLRTIMV	KNS-QWGGDP	ILGQYNFEDE	LTPESVFNQI
SARS CoV	PLTQSHVDIL	GPLSAGTGIA	VLDMAALKE	LLQNGMNGRT	ILGSTLEDE	FTPFDDVVRQM

	3725 3735 3745 3755 3765 3775
EMCR	YGVNLQS--- GKVIQGLRTM FLFSVFFTMF WAELFIYNT INWNPVILTP IFCLLLFLSL
229E	FGVNLQS--- GKTTSMFKSI SLFAGFFVMF WAELFVYTTT INWNPGLTTP FMILLVALSL
PEDV	YGVNLQ--- GYVSRACRNV LLVGSFLTF WSELVSYTKF FWVNPQGYVTP MFACLSLLSS
TGEV	YGVNLQA--- GKVKSEFFPI MTAMTILEAF WLEFFMYTPF TWINPTFVSI VLAVTTLIST
OV43	AGIRLQSKRT RLFRGTVCWI MASTFLFSCI ITAFVKWTF MYVTNNMES- ITFCALCVIS
BoCoV	AGIRLQSKRT RLVRGIVCWI MASTFLFSCI ITAFVKWTF MYVTNNMS- ITFCALCVIS
MHV	AGVKLQSKRT RVVKGTCWI LASTLLFCSI ISAFVKWTF MYVTTHMLG- VTLCALCFVS
AIBV	GGVRLQS--- -SFVRKATSW FWSRCVLACF LFVLCALVF TAVPLKFYVY AAVILLMAVL
SARS CoV	SGVTQGGFK KIVKGTHWM LLTFLTSLLI LVQSTQWSLF FFVYENAFLP FTLGIMAIAA

	3785 3795 3805 3815 3825 3835
EMCR	VLTMLFKHKF LFLQVFLPT VIATALYN-- --CVLDYYIV KFLADHEN-Y NVSVLQMDVQ
229E	CLTFVVKHKV LFLQVFLPS IIVAAIQN-- --CAWDYHVT KVLAEKFD-Y NVSVNQMDIQ
PEDV	LLMTFLHKHT LFFQVFLIPA LIVTSCIN-- --LAEDVEVY NYLAEHFD-Y HVSIMGFNAQ
TGEV	VFVSGIKHKM LFFMSFVLPS VILVTAHN-- --LFWDFSYY ESLQSIVENT NTMLFPLVMDQ
OV43	LAMLLVKHKH LYLTMYITPV LFTLLYNNY- -LVVYKHTFR GYVYAWLSY VPSVEYTYTD
BoCoV	LAMLLVKHKH LYLTMYIIPV LFTLLYNNY- -LVVYKHTFR GYVYAWLSY VPSVEYTYTD
MHV	FAMLLVKHKH LYLTMYIMPV LCTLFYTN- -LVVYKQSF GLAYAWLSH FPAVDYTYMD
AIBV	FISTVKHVM AYMDTFLPT LITVIIGVCA EVPIYNTLI SQVVFISQW YDPVVFDTMV
SARS CoV	CAMLLVKHKH AFLCLFLLPS LATVAYFN-- -MVMPASWV MRIMTWLELA DTSLSGYRLK

	3845 3855 3865 3875 3885 3895
EMCR	GLVNVLCFL VVFLH---TW RFSKERFTHW FTYVCSLIAV ATYTFYSGD- -----F
229E	GFVNIFICLF VALLH---TW RFAKERCTHW CTYLFSLIAV LYTALYSYD- -----Y
PEDV	GLVNVFCFV VTILHGYTW RFFN-TPASS VTYVALLTA AYNIFYASD- -----I
TGEV	GVMLTVFCFI VFVTVSVRFF TCKQSWFLA VTTILVIFNM VKIFGTSDEP WTENQIAFCF
OV43	EVIYGMILLV GMVFTLRSI NHDLSFIMF VGRLSVFSL WYKGSNLEEE -----I
BoCoV	EVIYGMILLI GMVFTLRSI NHDLSFIMF VGRVISVSL WYMGSNLEEE -----I
MHV	EVLYGVVLLV AMVFTMRIS NHDVFSVMFL VGRLVSLVSM WYFGANLEEE -----V
AIBV	PWMLPLVLY TAFKCVQGCY MNSFNTSLM LYQFVKLGFV IYTSNTTLTA YTEGNWELFF
SARS CoV	DCVMYASALV LLILMTARTV YDDAARVWT LMNVITLVYK VYGNALDQA -----I

	3905 3915 3925 3935 3945 3955
EMCR	LSLLVMFLCA ISSDWMYIGAI VFRLSRLIIF FSPE--SVFS VFQDVKLTIV VYLICGYLVC
229E	VSLVMFLCA ISNEWYIGAI IFRICRFGVA FLPV--EYVS YFDGVKTULL FYMLLGFVSC
PEDV	LSCAMTLFAS VTGNWVFGAV CYKVAVMAL RFP---TFVA IFGDIKSVF CYLVGYFTC
TGEV	VNMLTMTVSL TTKDWMVIA SYRIAYYIVV CVMP-SAFVS DFGFMKCSI VYMACGYLFC
OV43	LLMLASLFGT YTW---TVL SMAVARVIAK WVAVNVLYFT DIPQIKIVLL CYLFIGYIIS
BoCoV	LLMLASLFGT YTW---TAL SMAARVIAK WVAVNVLYFT DIPQIKIVLV CYLFIGYIIS
MHV	LLFLTSLFGT YTW---TML SLATAKVIK WLAVNVLYFT DVPQVKLVLL SYLCIGYVCC
AIBV	ELVHTTVLAN VSSNSLIGLF VFCAKWMYLY YCN-----AT YLNNYVLMV MNCIGWLCT
SARS CoV	SMWALVISVT SNYSGVVTI MFLARAIVFV CVEYPLLF I TGNTLQCIML VYCLFGYCCC

	3965 3975 3985 3995 4005 4015
EMCR	TYWGILYWFN RFFKCTMGVY DFKVSAAEFK YMVANGLHAP YGPFDAWLVS FKLLGIGGDR
229E	MYGILLYWIN RFFKCTLGVY DFCVSPAEEK YMVANGLNAP NGPFDALFLS FKLMGIGGPR
PEDV	CFYGILYWFN RFFKVSQGVY DYTVAEEFK YMVANGLRAP TGTLDLSLLS AKLIGIGGER
TGEV	CYYGILYWFN RFTCMTCGVY QFTVSAALK YMTANNLSAP KNAYDAMIS AKLIGVGGKR
OV43	CYWGFLSLMN SLFRMPLGVY NYKISVQELR YMNANGLRPP KNSFEALMLN FKLLGIGGVP
BoCoV	CYWGFLSLMN SLFRMPLGVY NYKISVQELR YMNANGLRPP KNSFEALMLN FKLLGIGGVP
MHV	CYWGVLSSLN SLFRMPLGVY NYKISVQELR YMNANGLRPP RNSFEALVLN FKLLGIGGVP
AIBV	CYFGLYWWVN KVFGTLGKY NFKVSVQYR YMLCHKINPP KTVWEVFTSN ILIQGIGGDR
SARS CoV	CYFGLFCLLN RYFRLTLGVY DYLVSTQEFR YMNSQGLLP KSSIDAFKLN IKLLGIGGKP

	4025 4035 4045 4055 4065 4075
EMCR	CIKISTVQSK LTDLKCTNVV LLGCLSSMNI AANSSEWAYC VDLHNKINLC DDPEKAQGM
229E	TIKVSTVQSK LTDLKCTNVV LMGILSNMNI ASNSKEWAYC VEMHNKINLC DDPETAQELL
PEDV	NIKISSVQSK LTDIKCSNVV LLGCLSSMNV SANSTEWAYC VDLHNKINLC NDPEKAQEM
TGEV	NIKISTVQSK LTEMKCTNVV LLGLLSKMHV ESNSKEWNYC VGLHNEINLC DDPEIVLEKL
OV43	IIEVSQFSK LTDVKCANVV LLNCLQHLHV ASNSKLWHYC STLHNEILAT SDSLVAFEKL
BoCoV	IIEVSQFSK LTDVKCANGV LLNCLQHLHV ASNSKLWQYC STLHNEILAT SDLGVAFEKL
MHV	VIEWSQISR LTDVKCSNVV LLNCLQHLHI ASSSKLWQYC STLHNEILAT SDSLVAFDKL
AIBV	VLPIATVQAK LSDVKCTTVV LMQLLTKLV EANSKMVYL VELHNKILAS DDVGECDNL
SARS CoV	CIKVATVQSK MSDVKCTSVV LLSVLQQLRV ESSSKLWQAC VQLHNDILLA KDTTEAFKEM

	4085 4095 4105 4115 4125 4135
EMCR	LALLAFLSK HSDFG-----LDGLIDSYF DNSSTLQSV SSVSMPSYI AYENARQAYE
229E	LALLAFLSK HSDFG-----LDGLVDSYF ENDSILQSV SSVFGMPSYV AYETARQAYE
PEDV	LALLAFLSK NSAFG-----LDDLLESYF NDNSMLQSV STYVGLPSYV IYENARQAYE
TGEV	LALLAFLSK HNTCD-----LSELIESYF ENTILQSV SAYAALPSWI ALEKARADLE
OV43	AQLLIVLFAN PAAVDSKCLT SIEEVCDY KONTVLQALQ SEFVNMAFV EYEVAKKNLD
BoCoV	AQLLIVLFAN PAAVDSKCLT SIEEVCDY KONTVLQALQ SEFVNMAFV EYEVAKKNLD
MHV	AQLLIVLFAN PAAVDSKCLT SIEEVSDYV RSTVLQALQ SEFVNMAFV EYELAKKNLD
AIBV	LGMILTLFCI DSTID-----LSEYCDIL KRSTVLQSVT QEFSHIPSYA EYERAKNLYE
SARS CoV	VSLLSVLLSM QGAVD-----INRLCEML DNRATLQAI SSSSLPSYA AYATAQEAYE

	4145 4155 4165 4175 4185 4195
EMCR	DAIANGSS-- --SOLIKQLK RAMNIAKSEF DHEISVQKKI NRMAEQAAQ MYKEARSVNR
229E	NAVANGSS-- --PQIIKQLK KAMNVAKEF DRESSVQKKI NRMAEQAAA MYKEARAVNR
PEDV	DAVNGSP-- --PQLVKQLR HAMNVAKEF DREASTQRKL DRMAEQAAAQ MYKEARAVNR
TGEV	EAKNDVS-- --PQILKQLT KAFNIAKSD FEREASVQKKL DKMAEQAAA MYKEARAVDR
OV43	EARFSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALT MYKEARINDK
BoCoV	EACSSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALT MYKEARINDK
MHV	EAKASGSAN-- --QQQIKQLE KACNIAKSAY ERDRAVAKKL ERMADLALT MYKEARINDK
AIBV	KVLVDSKNGG VTQOELAA YR KAANIAKSVF DRDLAVQKKL DSMAERAMTT MYKEARVTD
SARS CoV	QAVANGDS-- --EVVLKKLK KSLNVAKSEF DRDAAMQRKL EKMAEQAMTQ MYQARSEDK

	4205 4215 4225 4235 4245 4255
EMCR	KSKVISAMHS LLFGMLRRLD MSSVETVLNL ARDGVVPLSV IPATSASKLT IVSPDLESYS
229E	KSKVVSAMHS LLFGMLRRLD MSSVDTILNM ARNGVVPLSV IPATSARLV VVVPDHDSFV
PEDV	KSKVVSAMHS LLFGMLRRLD MSSVDTILNL AKDGVVPLSV IPAVSATKLN IVTSDIDSYN
TGEV	KSKVVSAMHS LLFGMLRRLD MSSVNTIIDQ ARNGVPLSI IPASATRLV VITPSLEVES
OV43	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVP LNA IPSLAANTLN IIVPDKSVYD
BoCoV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVP LNA IPSLAANTLT IIVPDKSVYD
MHV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVP LNA IPSLTNTLT IIVPDKSVYD
AIBV	RAKLVSSLHA LLFSMLKKID SEKLVNLFDO ASSGVVPLAT VPIVCSNKL LVIIPDETWW
SARS CoV	RAKVTSAMQT MLFTMLRKLD NDALNNIINN ARDGCVP LNI IPLTTAAKLM VVVPDYGT YK

	4265 4275 4285 4295 4305 4315
EMCR	KIVCDGSVHY AGVWVTLNDV KDNDRP VHV KEITRENVET LT-----WPL ILNCERVVK-
229E	KMMVDGFVHY AGVWVTLQEV KNDGKXVHL KDVTENQEI LV-----WPL ILTCERVVK-
PEDV	RIQREGCVHY AGTIWNIIDI KNDGKXVHV KEVTAQNAES LS-----WPL VLGCERIVK-
TGEV	KIRQENNVHY AGAIWITIEV KDANGSHVHL KEVTAANELN LT-----WPL SITCERTTK-
OV43	QVVDNVYVTY AGNVWQIQT I QSDGNTKQL NEISDDCN-- -----WPL VIIANRYNE-
BoCoV	QVVDNVYVTY AGNVWQIQT I QSDGNTKQL NEISDDCN-- -----WPL VIIANRYNE-
MHV	QVVDNVYVTY AGNVWQIQT I QSDGNTKQL NEISDDCN-- -----WPL VIIANRYNE-
AIBV	KCEGVHVHTY STVVWNIDTV IDADGTELHP TSTGSLTYC ISGANIAPWL KVNLTNRGNH
SARS CoV	NTCDGNTFTY ASALWEIQV VDADSKIVQL SEINMDNSPN LA-----WPL IVTALRAN--

	4325 4335 4345 4355 4365 4375
EMCR	----LQ-NNE IMPGKLKQKP MKAEG--DGG VLDGDNALYN TEGGKTFMYA YISNKADLKF
229E	----LQ-NNE IMPGKMKVKA TRGEG--DGG ITSEGNALYN NEGGRAFMYA YVTTKPGMKY
PEDV	----LQ-NNE IIPGKLKQRS IKAEG--DG- IVGEGKALYN NEGGRTFMYA FISDKPDLRV
TGEV	----LQ-NNE IMPGKLKERA VRASATLDGE AFGSGKALMA SESGKSFMYA FIASDNNLKY
OV43	VSATVLQNN LMPAKLKIQV VNSGPDQTCN TPT--QCYYN NSNNGKIVYA ILSDVDGLKY
BoCoV	VSATVLQNN LMPAKLKIQV VNSGPDQTCN TPT--QCYYN NSYNGKIVYA ILSDVDGLKY
MHV	VSSVVLQNN LMPQKLRTQV VNSGSDMNCN TPT--QCYYN TTGMGKIVYA ILSDCDGLKY
AIBV	KVDVVLQNN LMPHGVKTKA CVAGVDQAH SVES-KCYT NISGNSVVA ITSSNPNLKY
SARS CoV	-SAVKLQNN LSPVALRQMS CAAGTTQTAC TDDNALAYN NSKGGREVL LLSHDQDLKW

	4385 4395 4405 4415 4425 4435
EMCR	VKWEYEGG-- CNTIELDSPC RFMVETPNP QVKYLYFVK LNTLRRGAVL GFIGATIRLQ
229E	VKWEHDSG-- VVTVELEPPC RFVIDTPTGP QIKYLYFVK LNNLRRGAVL GYIGATVRLQ
PEDV	VKWEFDGG-- CNTIELEPPC RFLVDSNGA QIKYLYFVK LNTLRRGAVL GYIGATVRLQ
TGEV	VKWEFNDG-- IPIELEAPL RFYVDGANGP EVKYLYFVK LNTLRRGAVL GYIGATVRLQ
OV43	TKILKDDGN- FVLELDPPC KFTVQDAKGL KIKYLYFVK CNTLARGVWV GTISSTVRLQ
BoCoV	TKILKDDGN- FVLELDPPC KFTVQDAKGL KIKYLYFVK CNTLARGVWV GTISSTVRLQ
MHV	TKIVKEDGN- CVVLELDPPC KFSVQDVKGL KIKYLYFVK CNTLARGVWV GTLSSTVRLQ
AIBV	ASFLEAGN- QIYVDLPPC KFGMKVGVK EVVYLYFIK TRSIVRGMV GAINSVVVLQ
SARS CoV	ARFPKSDGTG TIYTELEPPC RFVTDTPKGP KVKYLYFIK LNNLNRGMV GSLAATVRLQ

	4445 4455 4465 4475 4485 4495
EMCR	AG-KQTELAV NSGLLTACAF SVDPAATYLE AVKHGAKPVS NCIMKLSNGA GNGQAITTSV
229E	AG-KQTEFVS NSHLLTHCSF AVDPAAAYLD AVKQAKPVG NCVKMLTNGS GSGQAITCTI
PEDV	AG-KQTEQAI NSSLLTLCAF AVDPARTYID AVKSGHKPVG NCVKMLANGS GNGQAVTNGV
TGEV	AG-KPTEHPS NSSLLTLCAF SPDPKAYVD AVKRGMQPVN NCVKMLSNGA GNGMAVTNGV
OV43	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIOQGGTPIA NCVKMLCDHA GTGMAITVKP
BoCoV	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIOQGGTPIA NCVKMLCDHA GTGMAITVKP
MHV	AG-TATEYAS NSAIRSLCAF SVDPKKTYLD YIQQGGAPVT NCVKMLCDHA GTGMAITIKP
AIBV	SKGHETEVD AVGILSLCSF AVDPADTYCK YVAAAGNQLG NCVKMLTVHN GSGFAITSKP
SARS CoV	AG-NATEVPA NSTVLSFCF AVDPKAYKD YLASGGQPT NCVKMLCTHT GTGQAITVTP

	4505 4515 4525 4535 4545 4555
EMCR	DANTNQDSYG GASICLYCRA HVPHP----S MDGYCKFKRG CVQVP-IGCL DPIRFCLENN
229E	DSNTTQDTYG GASVCIYCRA HVAHP----T MDGFCQYKRG WVQVP-IGTN DPIRFCLENT
PEDV	EASTNQDSYG GASVCLYCRA HVEHP----S MDGFCRLKRG YVQVP-LGTV DPIRFVLEND
TGEV	EANTQDQSYG GASVCIYCRA HVEHP----A IDGLCRYKRG FVQIP-TGTQ DPIRFCLENE
OV43	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSYVLTHD
BoCoV	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSYVLTHD
MHV	EATTNQDSYG GASVCIYCRS RVEHP----D VDGLCKLRGK FVQVP-LGK DPVSYVLTHD
AIBV	SPTPDQDSYG GASVCLYCRA HIAHPGSVGN LDGRQCQFSG FVQIP-TTEK DPVGFCLRNK
SARS CoV	EANMDQESFG GASCCLYCRC HIDHP----N PRGFCDLKRG YVQIPPTTCAN DPVGFCLRNT

	4565	4575	4585	4595	4605	4615
EMCR	VGNVCGCWL	HGCACDRTTI	QSVDIS----	YLNRRARGSSA	-ARLEPCN-G	TDIDKCVRAF
229E	VCKVCGCWL	HGCTCDRTAI	QSFDSN----	YLNRRVGGSSA	-ARLEPCN-G	TDIDYCVRAF
PEDV	VCKVCGCWL	NGCTCDRSIM	QSTDYG----	LFKRVRGSSA	-ARLEPCN-G	TDQHVYRAF
TGEV	VGVVCGCWL	NGCMCDRTSM	QSFVDQSY-	LFKRVRGSSA	-ARLEPCN-G	TDPDHVSRAF
OV43	VCRVCGFWRD	GSCSCVSTDT	TVQSKDTN--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
BoCoV	VQVCGFWRD	GSCSCVSTDT	TVQSKDTN--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
MHV	VQVCGFWRD	GMFLCR-HRL	PVSVKRHE--	LFKRVRGTSV	NARLVPCASG	LSTDVQLRAF
AIBV	VCTVCGCWIG	YGCQCDLSRQ	PKSSVQS---	----VAGASD	FDKNYLN--	YGVAVRLGMF
SARS CoV	VCTVCGMWKG	YGCSCDQLRE	PLMQSADAST	FLNRVCGVSA	-ARLTPCGTG	TSTDVYVRAF

	4625	4635	4645	4655	4665	4675
EMCR	DIYNKNVSFL	GKCLKMNCVR	FKNADLK---	-DGYFVIKRC	TKSVMEHEQS	MYNLLNFSGA
229E	DVYNKDASFI	GKNLKSNCVR	FKNVOKD---	-DAFYIIVKRC	IKSVMDEHQS	MYNLLKGCHA
PEDV	DIYNKDVACL	GKFLKVNCR	LKNLKH---	-DAFYVVKRC	TKSAMEHEQS	IYSRLKECGA
TGEV	DIYNKDVACI	GKFLKTNCNR	FRNLKH---	-DAYIIVKRC	TKTVMDHEQV	CYNDLKDSCGA
OV43	DIYNASVAGI	GLHLKVNCCR	FORVDENGDK	LQDFVVKRT	DLTIYNREMK	CYERVKDCKF
BoCoV	DICNASVAGI	GLHLKVNCCR	FORVDENGDK	LQDFVVKRT	DLTIYNREME	CYERVKDCKF
MHV	DICNANRAGI	GLYKVNCCR	QRADEDGNT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV
AIBV	QNLKRNCRF	QELRDTEDGN	LEYLDS----	---YFVVKQT	TPSNYEHEKS	CYEDLKS-EV
SARS CoV	DIYNKXVAGF	AKFLKTNCCR	FQEKDEEGNL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA

	4685	4695	4705	4715	4725	4735
EMCR	LAEHDFFTWK	DGRVIYGNVS	RHNLKRYTMM	DLVYAMRNFD	EQNCDVLKEV	LVLGTGCCDNS
229E	VAKHDFFTWK	EGRTIYGNVS	RQDLTKRYTMM	DLCFALRNFD	EKDCVEFKEI	LVLGTGCCSTD
PEDV	IAEHDFFTWK	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCVDLRSI	LKIVGACEES
TGEV	VAEHDFFTYK	EGRCFEGNVA	RRNLTKRYTMM	DLCYAIRNFD	EKNCEVLKEI	LVTVGACTEE
OV43	VAEHDFFTFD	VEGSRVPHIV	RKDLTKRYTML	DLCYALRHFD	RNDCHLLCDI	LSIYAGCEQS
BoCoV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKRYTML	DLCYALRHFD	RNDCHLLCDI	LSIYAGCEQS
MHV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKRYTML	DLCYALRHFD	RNDCHLLCDI	LSIYAGCEQS
AIBV	TADHDFFTFN	KN---IYNIS	RQRLTKRYTMM	DFCYALRHFD	PKDCEVLKEI	LVTYGCIEDY
SARS CoV	VAVHDFFTFR	VDGDMVPHIS	RQRLTKRYTMA	DLVYALRHFD	EGNCDTLKEI	LVTYNCCDD

	4745	4755	4765	4775	4785	4795
EMCR	----YFDSKG	WYDPVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD
229E	----YFEMKN	WFDPIENEDI	HRVYAALGRV	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD
PEDV	----YFNKVK	WFDPIENEDI	HRVYALLGTI	VARAMLKCA	FCDAIVEKGY	IGVITLDNQD
TGEV	----YFNKVK	WFDPIENEDI	HRVYALLGTI	VARAMLKCA	FCDAIVEKGY	IGVITLDNQD
OV43	----YFTKKD	WYDFVENPDI	INVYKLGPI	FNRALVSATE	FADKLVEVGL	VGVLTLDNQD
BoCoV	----YFTKKD	WYDFVENPDI	INVYKLGPI	FNRALVSATE	FADKLVEVGL	VGVLTLDNQD
MHV	----YFQKKD	WYDFVENSDI	INVYKLGPI	FNRALLNTAK	FADTLVEAGL	VGVLTLDNQD
AIBV	HPKWFEENKD	WYDFVENSKY	YVMLAKMGPI	VRRALLNAIE	FGNLMVEKGY	VGVLTLDNQD
SARS CoV	----YFNKVK	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAIRDAGI	VGVLTLDNQD

	4805	4815	4825	4835	4845	4855
EMCR	LNGNFYDFGD	FVSLPNMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKS DI	FGSDFKTFDL
229E	LNGNFYDFGD	FVSLPNMGV	PCCTSYYSYM	MPVGMNTNCL	ASECFMKS DI	FGQDFKTFDL
PEDV	LNGDFYDFGD	FTCSIKMGV	PICTSYYSYM	MPVGMNTNCL	ASECFVKS DI	FGEDFKSYDL
TGEV	LNGNFYDFGD	FVKTAPGFGC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKS DI	YGSDFKQYDL
OV43	LNGKWFYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
BoCoV	LNGKWFYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
MHV	LYGQWFYDFGD	FVKTAPGCGV	AVADSYYSYM	MPMLTMCHAL	OSELFING--	---TYREFDL
AIBV	LNGKFYDFGD	FQKTAPGAGV	PVFDTSYYSYM	MPILMTDAL	APERFYFYDV	H-KGYKSYDL
SARS CoV	LNGNWFYDFGD	FVQVAPGCGV	PIVDSYYSLL	MPILTLTRAL	AAESHMDADL	A-KPLIKWDL

	4865	4875	4885	4895	4905	4915
EMCR	LKYDFTTEHKE	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHC	ANFNLTFTATT	IPGTAFGPLC
229E	LKYDFTTEHKE	NLFNKYFKYW	GQDYHPDCVD	CHDEMCIHLC	SNFNLTFTATT	IPNTAFGPLC
PEDV	LEYDFTTEHKT	ALFNKYFKYW	GLQYHPNCVD	CSDEQCIHVC	ANFNLTFTSTT	IPITAFGPLC
TGEV	LAYDFTTEHKE	YLFQKYFKYW	DRTYHPNCSD	CTSDECIHHC	ANFNLTFSMT	IPMTAFGPLV
OV43	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV
BoCoV	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV
MHV	VQYDFTDFKL	ELFNKYFKYW	SMTYHPNTCE	CEDDRCIIHC	ANFNILFSMV	LPKTCFGPLV
AIBV	LKYDYTEEKQ	ELFQKYFKYW	DQYHPNCRD	CSDDRCIIHC	ANFNILFSTL	IPQTSFGNLC
SARS CoV	LKYDFTTEERL	CLFDRYFKYW	DQYHPNCIN	CLDDRCIIHC	ANFNVLFTSTV	FPPTSFGPLV

	4925	4935	4945	4955	4965	4975
EMCR	RKVFIIDGVPL	VTTAGYHFQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
229E	RKVFIIDGVPL	VTTAGYHFQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
PEDV	RKCVIIDGVPL	VTTAGYHFQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
TGEV	RKVFIIDGVPL	VTTAGYHFQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
OV43	RQIFVGVVPP	VVSIGYHYKE	LGVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
BoCoV	RQIFVGVVPP	VVSIGYHYKE	LGVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
MHV	RQIFVGVVPP	VVSIGYHYKE	LGVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
AIBV	RKVFIIDGVPL	IATCGYHSKE	LGVMMNDNT	MSFSKMLSQ	LMQFVGDPA	LVGTSNNLVD
SARS CoV	RKIFVGVVPP	VVSTGYHFRE	LGVMMNDQDV	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD

	4985	4995	5005	5015	5025	5035
EMCR	QRTICFSVAA	LSTGLTNQVV	KPGHFNKEFY	NFLRLRGFFD	EGSELTCLKHF	FFAQNGDAAV
229E	KRTVCFSVAA	LSTGLTSQTV	KPGHFNKEFY	DFLRSGQFFD	EGSELTCLKHF	FFTQKGDAAV
PEDV	QRTVCFSVAA	LGTGMTNQT	KPGHFNKEFY	DFLEQGFSS	EGSELTCLKHF	FFAQKVDAAV
TGEV	QRTVCFSVAA	LSTGITYQTV	KPGHFNKEFY	DFITERGFFE	EGSELTCLKHF	FFAQGGEAAM
OV43	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKH	FFTQDGNAAI
BoCoV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKH	FFTQDGNAAI
MHV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKH	FFTQDGNAAI
AIBV	LRTSCFSVCA	LTSGITHQTV	KPGHFNKEFY	DFAEKAGMFK	EGSSIPLKH	FYPQTGNAAI
SARS CoV	KRTTCFSVAA	LTNNVAFQTV	KPGNFNQDFY	DFAVSKGFFK	EGSSVELKH	FFAQDGNAAI

	5045	5055	5065	5075	5085	5095
EMCR	KDFDYRYNR	PTMLDQCAR	VTYKIVSRYF	DIYEGGCIKA	CEVVVTNLNK	SAGWPLNKF
229E	KDFDYRYNR	PTMLDQCAR	VAYQVAARYF	DCYEGGCITS	REVVTNLNK	SAGWPLNKF
PEDV	KDFDYRYNR	PTVLDICQAR	VYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKF
TGEV	TDFNYRYNR	VTVLDICQAO	FVYKIVGKYF	ECYDGGCINA	REVVTNNDK	SAGYPLNKF
OV43	TDYNYKYNL	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
BoCoV	TDYNYKYNL	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
MHV	TDYNYKYNL	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
AIBV	NDYDYRYNR	PTMFDICQLL	FCLEVTSKYF	ECYEGGCIKA	SQVVVNNDK	SAGYFNNKF
SARS CoV	SDYDYRYNL	PTMCDIRQLL	FVLEVVKYF	DCYDGGCINA	NQVIVNNLDK	SAGYFNNKF

	5105	5115	5125	5135	5145	5155
EMCR	KASLYYESIS	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ
229E	KAGLYYESIS	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ
PEDV	KAGLYYESIS	YEEQDELYAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ
TGEV	KARLYYETLS	YEEQDALFAL	TKRNVLPMT	QMNLYAISG	KARARTVGGV	SLLSTMTTRQ
OV43	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
BoCoV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
MHV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
AIBV	KARLYYEMS-	LEEQDQLFEI	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTNRQ
SARS CoV	KARLYYDMS	YEDQDALFAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SICSTMTNRQ

	5165	5175	5185	5195	5205	5215
EMCR	YHQKHLKSIV	NTRNATVVIG	TTKFYGGWNN	MLRLTIDGVE	NPMLMGWDYP	KCDRALPNMI
229E	FHQKCLKSIV	ATRNATVVIG	TTKFYGGWNN	MLKNLMADVD	DPKLMGWDYP	KCDRALPNMI
PEDV	YHQKHLKSIV	NTRGASVVIG	TTKFYGGWNN	MLKNLMADVD	NPCLMGWDYP	KCDRALPNMI
TGEV	YHQKHLKSIA	ATRNATVVIG	STKFYGGWNN	MLKNLMADVD	NGCLMGWDYP	KCDRALPNMI
OV43	FHQKCLKSIA	ATRGVPPVIG	TTKFYGGWDD	MLRLIKDVO	NPVLMGWDYP	KCDRALPNLL
BoCoV	FHQKCLKSIA	ATRGVPPVIG	TTKFYGGWDD	MLRLIKDVO	NPVLMGWDYP	KCDRALPNLL
MHV	FHQKCLKSIA	ATRGVPPVIG	TTKFYGGWDD	MLRLIKDVO	SPVLMGWDYP	KCDRALPNLL
AIBV	FHQKILKSIV	NTRNASVVIG	TTKFYGGWNN	MLRLIQGVE	DPILMGWDYP	KCDRALPNLL
SARS CoV	FHQKLLKSIA	ATRGATVVIG	TSKFYGGWNN	MLKTVYSQVE	TPHLMGWDYP	KCDRALPNLL

	5225	5235	5245	5255	5265	5275
EMCR	RMISAMVLGS	KHVNCCCTVD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA
229E	RMLSAMILGS	KHVTCTASD	RFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
PEDV	RMISAMILGS	KHTTCCSSTD	RFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
TGEV	RMASAMILGS	KHVGCCCTND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDATTAYA
OV43	RIVSSLVLAR	KHETCCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
BoCoV	RIVSSLVLAR	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
MHV	RISSSLVLAR	KHDSCCSHTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
AIBV	RTAASLVLAR	KHTNCCSWSE	RIYRLYNECA	QVLSEIVLAT	GGIYVKPGGT	SSGDATTAYA
SARS CoV	RIMASLVLAR	KHNTCCNLSH	RFYRLANECA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA

	5285	5295	5305	5315	5325	5335
EMCR	NSIFNIFQAV	SSNINRLLSV	PSDSCNNVNV	RDQLRRLYDN	CYRLTSVEES	FIDDIYGYLR
229E	NSVFNIFQAV	SSNINCVLSV	NSSNCNNFNV	KKLQRLYDN	CYRNSNVDES	FVDDFYGYLQ
PEDV	NSVFNIFQAV	SANVNKLLSV	DSNVCHNLEV	QQLQRLYEC	CYRSTIVDDQ	FVVEYGYLR
TGEV	NSAFNIFQAV	SANVNKLLGV	DSNACNNVT	KSQKRLYDN	CYRSSIDE	FVVEYGYLR
OV43	NSVFNIFQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDKVDST	FVTEYEFNL
BoCoV	NSVFNIFQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDMVDST	FVTEYEFNL
MHV	NSVFNIFQAV	SANVCALMSC	NGNKIEDLSI	RELQKRLYSH	VYRADHVDPA	FVTEYEFNL
AIBV	NSVFNIQAT	SANVARLLSV	ITRDIVYDNI	KSLQYELYQQ	VYRRVNFDP	FVEKFSYLC
SARS CoV	NSVFNIFQAV	TANVNALLST	DGNKIADKYV	RNLQRLYEC	LYNRDNDVHE	FVDEFYAYLR

	5345	5355	5365	5375	5385	5395
EMCR	KHFSMMLSD	DGVVCYNKDY	AELGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKPH
229E	KHFSMMLSD	DSVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH
PEDV	KHFSMMLSD	DGVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMASCKW	IEPDINKGPH
TGEV	KHFSMMLSD	DGVVCYNKDY	ADLGYVADLN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGPH
OV43	KHFSMMLSD	DGVVCYNSDY	ASKGYIANIS	AFQQLVYYQN	NVFMSESKCW	VEHDINNGPH
BoCoV	KHFSMMLSD	DGVVCYNSDY	ASKGYIANIS	AFQQLVYYQN	NVFMSESKCW	VENDINNGPH
MHV	KHFSMMLSD	DGVVCYNSEF	ASKGYIANIS	AFQQLVYYQN	NVFMSESKCW	VETDIEKGP
AIBV	KHFSMMLSD	DGVVCYNNTL	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP
SARS CoV	KHFSMMLSD	DAVVCYNSNY	AAQGLVASIK	NFXAVLYYQN	NVFMSESKCW	TETDLTKGPH

	5405	5415	5425	5435	5445	5455
EMCR	EFCSQHTMQI	VOKDGTYYLP	YDPSRILSA	GVFVDDVVKT	DAVVLLXRYV	SLAIDAYPLS
229E	EFCSQHTMQI	VDENGKYYLP	YDPSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS
PEDV	EFCSQHTMQI	VDEKGTYYLP	YDPSRILSA	GVFVDDVVKT	DAVVLLERYV	SLAIDAYPLS
TGEV	EFCSQHTLQI	VDPDGDYYLP	YDPSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT
OV43	EFCSQHTMLV	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
BoCoV	EFCSQHTMLV	KMDGDDVYLP	YVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
MHV	EFCSQHTMLV	KMDGDEVYLP	YDPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
AIBV	EFCSQHTMLV	EVDGEPKYL	YDPSRILGA	GVFVDDVOKT	EPVAVMERYI	ALAIIDAYPLV
SARS CoV	EFCSQHTMLV	KQGDYVYLP	YDPSRILGA	GCFVDDIVKT	DGTLMIERFV	SLAIDAYPLT

	5465	5475	5485	5495	5505	5515
EMCR	KHPNSEYRKV	FYVLLDWVKH	LNKNLNEGVL	ESFSVTLLDN	QEDKFWCEDF	YASMYENSTI
229E	KHPKPEYRKV	FYALLDWVKH	LNKTLNEGVL	ESFSVTLLDE	HESKFWDESF	YASMYEKSTV
PEDV	KHENPEYKVV	FYVLLDWVKH	LYKTLNAGVL	ESFSVTLLDE	STAKFWDESF	YANMYEKSAV
TGEV	KHPKPAYQKV	FYVLLDWVKH	LQKNLNAAGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV
OV43	YHENEYQKV	FRVYLAYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
BoCoV	YHENEYQKV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
MHV	YHENPEYQNV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV
AIBV	YHENEYKVV	FRVLLAYIRK	LYQELSQNML	MDYSFVMDID	KGSKFWEQEF	YENMYRAPTT
SARS CoV	KHPNQEYADV	FRVLYQYIRK	LHDELTGHML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTV

	5525	5535	5545	5555	5565	5575
EMCR	LQAAGLCVVC	GSQTVLRCDG	CLRKPMCLCTK	CAYDHVFGTD	HKFILAITPY	VCNASGCCVS
229E	LQAAGLCVVC	GSQTVLRCDG	CLRRFMLCTK	CAYDHVFGTD	HKFILAITPY	VCNTSGCNVN
PEDV	LQAAGLCVVC	GSQTVLRCDG	CLRRFMLCTK	CAYDHVIGTT	HKFILAITPY	VCCASDCGVN
TGEV	LQAAGMCVVC	GSQTVLRCDG	CLRRPFLCTK	CAYDHVMGTG	HKFIMSITPY	VCSFNGCNVN
OV43	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
BoCoV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
MHV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CAYDHVMSTD	HKYVLSVSPY	VCNSPGCDVN
AIBV	LQSCGVCVVC	NSQTSLRCSG	CIRKPLLCCK	CCYDHVMHTD	HKNVLSINPY	ICSQGLCGEA
SARS CoV	LQAVGACVLC	NSQTSLRCSG	CIRKPLLCCK	CCYDHVISTS	HKLVLVSVPY	VCNAPGCDVT

	5585	5595	5605	5615	5625	5635
EMCR	DVKKLYLGGL	NYCYTNHKKPQ	LSFPLCSAGN	IFGLYKNSAT	GSLOVEVFNR	LATSOWTDVR
229E	DVTIKLYLGGL	NYCYVDHKKPH	LSFPLCSAGN	VFGLYKSSAL	GSMOIVDFNK	LSTDWSDIR
PEDV	DVTIKLYLGGL	SYWCHHKKPR	LAFFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS
TGEV	DVTIKLYLGGL	SYCYMNHKKPQ	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSOWTNVE
OV43	DVTIKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
BoCoV	DVTIKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
MHV	DVTIKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNK	IASCWTEVD
AIBV	DVTIKLYLGGM	SYFCGNHKKP	LSIPLVSNGT	VFGIYRANCA	GSENVDDFNQ	LATTNWSIVE
SARS CoV	DVTQLYLGGM	SYCYCKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDFNA	IATCOWTNAG

	5645	5655	5665	5675	5685	5695
EMCR	DYKLANDVKD	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKEILLLSE	SGKVPPLNR
229E	DYKLANDAKE	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKEILLLSE	SGKAKPPLNR
PEDV	DYKLANDVKD	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKEILLLSE	VGRPKPPLNR
TGEV	DYKLANNVKE	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKEIVLQWE	ASKTKPPLNR
OV43	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVPKPLNK
BoCoV	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVPKPLNK
MHV	DYVLANECTE	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SRELILSWE	IGKVPKPLNK
AIBV	PYILANRCSO	SLRRFAAETV	KATEELHKQ	FASAEVREVF	SRELILSWE	PGKTRPPLNR
SARS CoV	DYILANTCTE	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SRELILSWE	VGKPRPPLNR

	5705	5715	5725	5735	5745	5755
EMCR	NSVFTCFQIS	KDSKFQIGEF	IFERVEYGSO	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA
229E	NSVFTCFQIT	KDSKFQVGEF	VFERVDYGSO	TVTYKSTATT	KLVPGMIFVL	TSHNVAPLRA
PEDV	NSVFTCFYHIT	KNTKFQIGEF	VFEKAEYDND	AVTYKTATT	KLVPGMIFVL	TSHNVQPLRA
TGEV	NSVFTCFQIS	KDKFIQIGEF	VFEQSEYGSO	SVYYKSTSTY	KLTPGMIFVL	TSHNVSPKLA
OV43	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDFVFL	TSHSVANLSA
BoCoV	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDFVFL	TSHSVANLSA
MHV	NYVFTGYHFT	SNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDFVFL	TSHSVANLSA
AIBV	NYVFTGYHFT	RTSKVQLGDF	TFEKGEGK-D	VVYYKATSTA	KLTVGDFVFL	TSHNVVSLVA
SARS CoV	NYVFTGYHFT	KNSKVQIGEF	TFEKGEGK-D	AVVYRGTTY	KLTVGDFVFL	TSHVMPLSA

	5765	5775	5785	5795	5805	5815
EMCR	PTIANQEKYS	SIYKLHPAFN	VSDAYANLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCSIGLGL
229E	PTMANQEKYS	TIYKLHPFEN	VSDAYANLVP	YYQLIGKQRI	TTIQGPPGSG	KSHCSIGIGV
PEDV	PTIANQERYS	TIHKLHPAFN	IPEAYSSLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCVIGLGL
TGEV	PTLVNQEKYN	TISKLYPVFN	IAEAYNTLVP	YYQMIGKQKF	TTIQGPPGSG	KSHCVIGLGL
OV43	PTLVQENYS	SIR-FASVYS	VLETFFQNNVV	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
BoCoV	PTLVQENYS	SIR-FASVYS	VLETFFQNNVV	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
MHV	PTLVQENYT	SIR-FASVYS	VPETFQNNVP	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
AIBV	PTLCQQTFS	RFVNLRPVNM	VPECFVNNIP	LYHLVGKQKR	TTVQGPPTGT	KSHFAIGLAV
SARS CoV	PTLVQEHYV	RITGLYPTLN	ISDEFSSNVA	NYQVGMQRY	STLQGPPTGT	KSHFAIGLAV

	5825	5835	5845	5855	5865	5875
EMCR	YYPGARIVFV	ACAHAAVDSL	CAKAMTVYSI	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYIF
229E	YYPGARIVFT	ACSHAAVDSL	CAKAVTAYSV	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYVF
PEDV	YYPGARIVFT	ACSHAAVDSL	CVKASTAYSN	DKCSRIIPQR	ARVECYDGFK	SNNTSAQYLF
TGEV	YYPQARIVYT	ACSHAAVDAL	CEKAANKFN	DRCSRIIPQR	IRVDCYTGFK	PNNTNAQYLF
OV43	FYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTTRKYVF
BoCoV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTTRKYVF
MHV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVDCYDKFK	VNDTTRKYVF
AIBV	YFSSARVVFT	ACSHAAVDAL	CEKAFKFLKV	DDCTRIIPQR	TTVDCFSKFK	ANDTGKKYIF
SARS CoV	YYPSARIVYT	ACSHAAVDAL	CEKALKYLP	DKCSRIIPAR	ARVECFDKFK	VNSTLEQYVF

	5885	5895	5905	5915	5925	5935
EMCR	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRLSYKHIV	YVGDPQQLPA	PRVMITKGVN
229E	STVNALPEVN	ADIVVVDEVS	MCTNYDLSVI	NQRISYKHIV	YVGDPQQLPA	PRVLISKGVN
PEDV	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRISYRHVV	YVGDPQQLPA	PRVMISRGTL
TGEV	CTVNALPEAS	CDIVVVDEVS	MCTNYDLSVI	NSRLSYKHIV	YVGDPQQLPA	PRTLINRGVL
OV43	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
BoCoV	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
MHV	TTINALPELV	TDIVVVDEVS	MLTNYELSVI	NSRVRARHYV	YIGDPAQLPA	PRVLLNKGTL
AIBV	TTINALPEVS	CDILLVDEVS	MLTNYELSVI	NGKINYQYVV	YVGDPQQLPA	PRTLNLN-GSL
SARS CoV	CTVNALPETT	ADIVVFDEIS	MATNYDLSVV	NARLRARHYV	YIGDPAQLPA	PRTLNLTKGTL

	5945	5955	5965	5975	5985	5995
EMCR	EPVDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCFKIFFK
229E	EPIDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCFKIFER
PEDV	EPKDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVRTVSEMVY	ENKFVPVKEA	SKQCFKIFCK
TGEV	QPDYNNVTQ	RMCTLGPDVF	LHKCYRCPAE	IVKTVSALVY	ENKFVPVNPPE	SKQCFKMFVK
OV43	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKFKAKNES	SSLCFKVYYK
BoCoV	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKFKAKNES	SSLCFKVYYK
MHV	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	HNKFKAKNDN	SSMCFKVVYK
AIBV	SPKDYNNVTN	LMVCVKPDIF	LAKCYRCPKE	IVDTVSTLVY	DKGFIANNPE	SRECFKVIYN
SARS CoV	EPEYFNSVCR	LMKTIGPDMF	LGTCRRCPAE	IVDTVSALVY	DNKFKAKHDK	SAQCFKMFVK

	6005	6015	6025	6035	6045	6055
EMCR	---GNVQVDN	GSSINRRQLE	IVKFLVKNP	SWSKAVFISP	YNSQNYVASR	FLGLQQTVD
229E	---GSVQVDN	GSSINRRQLD	VVKRFIHKNS	TWSKAVFISP	YNSQNYVAAR	LLGLQQTVD
PEDV	---GNVQVDN	GSSINRRQLD	VVRMFLAKNP	RWSKAVFISP	YNSQNYVASR	LLGLQQTVD
TGEV	---GQVQIES	NSSINNRQLE	VVKAFLAHNP	KWRKAVFISP	YNSQNYVARR	LLGLQQTVD
OV43	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFPAKR	VLGLQQTVD
BoCoV	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFPAKR	VLGLQQTVD
MHV	---GQTHES	SSAVNMQQIY	LISKFLKANP	SWSNAVFISS	YNSQNYVAKR	VLGLQQTVD
AIBV	NGNSDVGHES	GSAYNTTQLE	FKVDFVCRNK	QWREAFIISP	YNAMNQRAYR	MLGLNVQTV
SARS CoV	---GVITHOV	SSAINRPQIG	VVREFLTRNP	AWRKAVFISP	YNSQNAVASK	ILGLPTQTV

	6065	6075	6085	6095	6105	6115
EMCR	SSQGSSEYDV	IYAQTSDDTAH	ACNVNRFNVA	ITRAKKGIFC	VMCDRT-LFD	SLKFFFEIKHA
229E	SAQGSSEYDV	IFAQTSDDTAH	ACNANRFNVA	ITRAKKGIFC	IMSDRT-LFD	ALKFFFEITMT
PEDV	SSQGSSEYDV	IYAQTSDDTAH	ASNVNRFNVA	ITRAKKGILC	IMCDRT-LFD	LLKFFELKLS
TGEV	SAQGSSEYDV	IYTQTSDDTAH	ATNVNRFNVA	ITRAKKGILC	IMCDRT-MYE	NLDFYELKDS
OV43	SAQGSSEYDV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
BoCoV	SAQGSSEYDV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
MHV	SAQGSSEYDV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	SLNFSTLTLD
AIBV	SSQGSSEYDV	IFCVTADSQH	ALNVNRFNVA	LTRAKGILV	VMRQRDELVS	ALKFTELDSE
SARS CoV	SSQGSSEYDV	IFTQTETTAH	SCNVNRFNVA	ITRAKGILC	IMSDRT-LYD	KLQFTSLTLD

	6125	6135	6145	6155	6165	6175
EMCR	-----DLHSS	-QVCGLFKNC	TRTPNLPPPT	HAHTFLSLSD	QFKTTGDLAV	QIGS-N-NVC
229E	-----DLQSE	-SSCGLFKDC	ARNPIDLPPS	HATTYLSLSD	RFKTSGDLAV	QIGN-N-NVC
PEDV	-----DLQAN	-EGCGLFKDC	SRGDDLLPPS	HANTFMSLAD	NFKTDQYLAV	QIGV-N-GPI
TGEV	-----GLQAK	PETCGLFKDC	SKSEQYIPPA	YATTYMSLSD	NFKTSDGLAV	NIG--T-KDV
OV43	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
BoCoV	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
MHV	KIN---NPRL	QCTTNLFKDC	SRSYAGYHPA	HAPSFLAVDD	KYKVGDLAV	CLNVAD-SAV
AIBV	T-----S--	LQGTGLFKIC	NKEFSGVHPA	YAVTTKALAA	TYKVNDLAA	LVNVEAGSEI
SARS CoV	RRN-VATLQA	ENVGTGLFKDC	SKIITGLHPT	QAPTHLSVDI	KFKTEG-LCV	DIPGIP-KDM

	6185	6195	6205	6215	6225	6235
EMCR	TYEHVISFMG	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLG	DVEGAHVCGD	NIGTNVPLQV
229E	TYEHVISFMG	FRFDVSMPPS	HSLFCTRDFA	MRNVRGWLG	DVEGAHVCGD	NIGTNVPLQV
PEDV	KYEHVISFMG	FRFDINIPNH	HTLFCTRDFA	MRNVRGWLG	DVEGAHVCGD	NIGTNVPLQL
TGEV	KYANVISFMG	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NIGTNVPLQL
OV43	TYSRILSLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
BoCoV	TYSRILSLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
MHV	TYSRILSLMG	FKLDLTLDDY	CKLFITRDEA	IRNVRAWVGF	DAEGAHAATRD	SIGTNFPLQL
AIBV	TYKHLISLLG	FKMSVNVGCG	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPFQV
SARS CoV	TYRRLISMMG	FKMNYQVNGY	PNMFITRDEA	IRNVRAWVGF	DVEGHAATRD	AVGTNLPQL

	6245	6255	6265	6275	6285	6295
EMCR	GFSNGVNEFV	QTEGCVSTNF	GDVIRPVCAK	SPPGEQFRHL	VPFLRKGQPW	LIVRRRIVQM
229E	GFSNGVDFA	QPEGCVLTNT	GSVVKPVRR	APPGEQFTHI	VPFLRKGQPW	SVLRKRIVQM
PEDV	GFSNGVDFV	RPEGCVVTES	GDYIKPVRR	APPGEQFAHL	LPFLRKGQPW	DVVRKRIVQM
TGEV	GFSNGVDFV	QTEGCVITEK	GNSIEVVKAR	APPGEQFAHL	IPLMRKGQPW	HIVRRRIVQM
OV43	GFSTGIDFV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGRHW	DVVRPRIVQM
BoCoV	GFSTGIDFV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGRHW	DVVRPRIVQM
MHV	GFSTGIDFV	EATGMFAERD	GYVFKKAVAR	APPGEQFKHL	VPLMSRGQKW	DVVRIRIVQM
AIBV	GFSTGADFV	TPEGLVDTSI	GNNFEPVNSK	APPGEQFNHL	RVLFSKAPKW	HVIRPRIVQM
SARS CoV	GFSTGCVNLVA	VPTGVVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM
	6305	6315	6325	6335	6345	6355
EMCR	ISDYLSNLSD	ILVFLVWAGS	LELTMMRYFV	KIGP-IKYCY	CGNSATCYNS	VSNEYCCFKH
229E	IADFLAGSSD	VLVFLVWAGG	LELTMMRYFV	KIGA-VKHCC	CGTVATCYNS	VSNDYCCFKH
PEDV	CSDYLANLSD	ILIFVLWAGG	LELTMMRYFV	KIGP-SKSCD	CGKVATCYNS	ALHTYCCFKH
TGEV	VCDYFDGLSD	ILIFVLWAGG	LELTMMRYFV	KIGR-PQKCE	CGKSATCYSS	SQSVYACFKH
OV43	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
BoCoV	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
MHV	LSDKLVDLAD	SVVLVTWAAS	FELTCLRYFA	KVGREVVCSV	CNKRATCFNS	RTGYYGCWRH
AIBV	LADNLCNVSD	CVFVTVCHG	LELTTLRYFV	KIGK-EQVCS	CGSRATTENS	HTQAYACWKH
SARS CoV	LSDTLKLSD	RVVFLVWAGH	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH
	6365	6375	6385	6395	6405	6415
EMCR	ALGCDYVYNP	YAFDIQQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKN
229E	ALGCDYVYNP	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFCVN
PEDV	ALGCDYLYNP	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKN
TGEV	ALGCDYLYNP	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKN
OV43	SVTCODYLYNP	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN
BoCoV	SVTCODYLYNP	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN
MHV	SYSCODYLYNP	LIVDIQQWGY	TGSLSTNHDL	ICSVHKGAVH	ASSDAIMTRC	LAVHDCFCKS
AIBV	CLGDFDYVYNP	LLVDIQQWGY	SGNLQFNHDL	HCNVHKGAVH	ASVDAIMTRC	LAINNAFCQD
SARS CoV	SVGDFDYVYNP	FMIDVQWGF	TGNLQSNHQQ	HCQVHGNHNV	ASCDAIMTRC	LAVHECFVKN
	6425	6435	6445	6455	6465	6475
EMCR	VDWTVTYPII	ANEKFINCGG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY
229E	VDWSITYPMI	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY
PEDV	VDWSITYPFI	GNEAVINKSG	RIVQSHTMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWF
TGEV	VDWSIVYPII	DNEEKINKAG	RIVQSHVMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPF
OV43	INWNVEYPPI	SNELSINTSC	RVLQRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
BoCoV	INWNVEYPPI	SNELSINTSC	RVLQRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
MHV	VNWSLEYPII	SNEVSNTSC	RLQRVMFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK
AIBV	VNWDLYPHI	ANEDEVNSSC	RYLQRMVILNA	CVDALKVNVV	YDIGNPKGIK	CVRGDNVFR
SARS CoV	VDWSVEYPPI	GDELRVNSAC	RKVQHMVVK	ALLADEFPVL	HDIGNPKAIA	CVQAEVEWK
	6485	6495	6505	6515	6525	6535
EMCR	CYDKQPVNSN	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTSVF
229E	CYDKNPINSN	---VKTLEYD	YMTHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL
PEDV	CFDKNPTNSN	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL
TGEV	CYDRDPINNN	---VRCLDYD	YMHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL
OV43	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
BoCoV	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
MHV	FYDASPIVKS	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
AIBV	FYDKNPVIRN	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNLVVC	RYDTRNLVSF
SARS CoV	FYDAQPCSDK	AYKIEELFYS	YATHHOKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLNNL
	6545	6555	6565	6575	6585	6595
EMCR	NLEGVNGGSL	YVNKHAFHTP	AYDKRAFVKL	KPMPPFFYDD	SDCDVVQ---	-EQVNYVPLR
229E	NLEGVNGGSL	YVNKHAFHTP	AYDKRAMAKL	KPAFFFFYYDD	GSCEVVH---	-DQVNYVPLR
PEDV	NLEGCGGGSL	YVNKHAFHTP	AFDKRAFAKL	KPMPPFFYYDD	TECDKLQ---	-DSINYVPLR
TGEV	SLEGCGGGAL	YVNKHAFHTP	AYDRRAFAKL	KPMPPFFYYDD	SNCELVD---	-GQPNYVPLK
OV43	NLPGCGGGSL	YVNKHAFHTK	PFARAAFEHL	KPMPPFFYYSD	TPCVYMDGMD	AKQVDYVPLK
BoCoV	NLPGCGGGSL	YVNKHAFHTK	PFARAAFEHL	KPMPPFFYYSD	TPCVYMDGMD	AKQVDYVPLK
MHV	NLPGCGGGSL	YVNKHAFHTS	PETRAAFENL	KPMPPFFYYSD	TPCVYMEGME	SKQVDYVPLR
AIBV	NLPGCGGGSL	YVNKHAFYTP	KFDRISFRNL	KAMPFFYYDS	SPCETIQVDG	-VAQDLVSLA
SARS CoV	NLPGCGGGSL	YVNKHAFHTP	AFDKSAFTNL	KQLPFFYYSD	SPCESHGKQV	VSDIDYVPLK
	6605	6615	6625	6635	6645	6655
EMCR	ASSCVTRCNI	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFDIET-NL
229E	ATNCITKNCNI	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL
PEDV	ASNCITKCNV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFSN--NL
TGEV	SNVCITKNCNI	GGAVCKKHAA	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNSKAL
OV43	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
BoCoV	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
MHV	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
AIBV	TKDCITKNCNI	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTKNLNPNYL	WKSFSFA---L
SARS CoV	SATCITRCNL	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTK---L

	6665 6675 6685 6695 6705 6715
EMCR	QSLFNIAFNV VKKGCFTGVD GELPVAVVND KVFVRYGDVD NLVFTNKTTL PTNVAFELFA
229E	QGLFNIAFNV VNKGSFVGAD GELPVAISGD KVFVRDGNPD NLVFNKTSLS PTNIAFELFA
PEDV	QGLFNIAFNV LKKGSEFVGDE GELPVAVVND KVLVRDGTVD TLVFTNKTSLS PTNVAFELFA
TGEV	QSLFNIAFNV VKKGAFTGLK GDLPTAVIAD KIMVRDGTVD KCIFTNKTSLS PTNVAFELFA
OV43	QSLFNIAFNV VKTGHYTGQA GEMPCAIIND KVVAKIDKED VVIFINNTTY PTNVAVELFA
BoCoV	QSLFNIAFNV VKTGHYTGQA GEMPCAIIND KVVAKIDKED VVIFINNTTY PTNVAVELFA
MHV	QSLFNIAFNV VNAGHFDGRA GELPCAVIGE KVIKIQNED VVVFKNNTPF PTNVAVELFA
AIBV	QSIDNIAYNM YKGGHYDAIA GEMPTVITGD KVFVIDQGE KAVFVNQTTL PTSVAFELFA
SARS CoV	QSLFNIAFNV VNKGHFDGHA GEAPVSIINN AVYTKVDGID VEIFENKTTL PVNVAFELFA

	6725 6735 6745 6755 6765 6775
EMCR	KRKMGTLTPLL SILKNLGVA TYKFLWDYE AERPFTSYTK SVCKYTDEN-----EDV
229E	KRKMGTLTPLL SILKNLGVA TYKFLWDYE AERPLTSFTK SVCKYTDFA-----EDV
PEDV	KRKMGTLTPLL TILRNLGVA TSKCVIWDYE AERPLTFTK OVCKYTDFA-----GDV
TGEV	KRKMGTLTPLL TILRNLGVA TYKFLWDYE AERPFSNFTK QVCSYTDLD-----SEV
OV43	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA RESIFCSNTY GVCMTYDLK-----FIDKL
BoCoV	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA RESIFCSNTY GVCMTYDLK-----LIDKL
MHV	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA KDSVFCSSY KVCKYTDLQ-----CIESL
AIBV	KRNIRTLFNN RILKGLGVDV TNGFVIWDYA NQTPLYRNTV KVCAYTDIE-----BNGL
SARS CoV	KRNIRTLFNN RILKGLGVDV TNGFVIWDYA REAPAHVSTI GVCMTYDIK KPTESACSSL

	6785 6795 6805 6815 6825 6835
EMCR	CVCFDNSIQG SYERFTLTNN AVLFSTVVIK N-----LTPIK LNFGMLNGMP VSSIKSDKGV
229E	CTCYDNSIQG SYERFTLTNN AVLFSTVVIK TGGKSLPAIK LNFGMLNGMA IATVKSSEDGN
PEDV	CTLCFDNSIQG SLERFSMTQN AVLMSTLAVK K-----LTGIR LTYGYLNGVP VN---THED-
TGEV	VTCFDNSIQG SFERFTTTTRD AVLISNNAVK G-----LSAIA LQYGLLNDLP VS---TVGN-
OV43	NVLFDGRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVG
BoCoV	NVLFDGRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVG
MHV	NVLFDGRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVG
AIBV	VVLYDDR-YG DYQSLAADDN AVLSTQCYK R-----YS YVEIPSNLLV QNGMPLKDG-
SARS CoV	TVLFDGRVEG QVDFLRNARN GVLITEGSKV G-----LT PSKGAQASV NGVTLIGES-

	6845 6855 6865 6875 6885 6895
EMCR	EKLNVWYTYV RKNQGFQDHY DG----- FTTQ
229E	IKNINWFVYV RKDGKPDVHY DG----- FTTQ
PEDV	-KPFWTYIYV RKNQGFEDYP DG----- YFTQ
TGEV	-KPFWTYIYV RKNQGFEDYP DS----- YFTQ
OV43	-TDCVFYFAV RKEGQDVIFS QFDSLGVSSN QSPQGNLGSN GKPGNVGGND ALSISTIFTQ
BoCoV	-TDCVFYFAV RKEGQDVIFS QFDSLGVSSN QSPQGNLGSN GKPGNVGGND ALATSTIFTQ
MHV	-SDVEFWFAM RRDGDDVIFS RTGSLPSHY RSPQGNPGGN -RVGDLSGNE ALARGTIFTQ
AIBV	---ANLYYK RVNGAFVTLN N----- TINTQ
SARS CoV	-VKTQFNYFK KVDG---IIQ- QLP----- ETYFTQ

	6905 6915 6925 6935 6945 6955
EMCR	GRNLSDFTPR SDMEYDFLNM DMGVFINKYK LEDFNFEHV YGDVSKTTLG GLHLLISQFR
229E	GRNLSDFTPR STMEEDFLNM DIGVFIQKYK LEDFNFEHV YGDVSKTTLG GLHLLISQFR
PEDV	GRTTADFSPR SDMEKDFLSM DMGLFINKYK LEDYGFHV YGDVSKTTLG GLHLLISQFR
TGEV	GRTTADFSPR STMEEDFLNM DTLFIQKYK LEDYGFHV YGDVSKTTLG GLHLLISQFR
OV43	SRVSSFTCR TDMKDFIAL DQDVFIQKYK LEDYAFEHV YGNFNQKIIG GLHLLIGLYR
BoCoV	SRVSSFTCR TDMKDFIAL DQDVFIQKYK LEDYAFEHV YGNFNQKIIG GLHLLIGLYR
MHV	SRFLSSFAPR SEMEKDFMOL DEDVFIQKYK LQDYAFEHV YGSFNQKIIG GLHLLIGLYR
AIBV	GRSYETFEPR SDIERDFLAM SEESFVERY -KDLGLQHL YGEVDKPLQ GLHTVIGMYR
SARS CoV	SRDLEDFKPR SQMETDFLEL AMDEFTQRYK LEGYAFEHV YGDFSHGQLG GLHLLIGLYR

	6965 6975 6985 6995 7005 7015
EMCR	LSKMGVLKAD DFVTASOTTL RCCTVTYLN LSSKVVCTYM DILLDDFVTI LK---SLDLG
229E	LSKMGVLKAE EFVAASDITL KCCTVTYLN PSSKTVCTYM DILLDDFVSV LK---SLDLT
PEDV	LACMGVLKID EFVSSNDSTL KSCCTVYADN PSSKVMCTYM DILLDDFVSI LK---SLDLS
TGEV	LAKMGVLSVQ EFMNNSDSTL KSCCTVYADN PSSKVMCTYM DILLDDFVTI LK---SLDLG
OV43	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVAL VK---SLNLN
BoCoV	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVAL VK---SLNLN
MHV	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVSI VK---SLNLN
AIBV	LLRANKLNAK SVTN-SOSDV MQNYFVLSN GSYKQVCTV DILLDDFLEL LRNLKEYGT
SARS CoV	RSQDSPLKLE DFIP-MDSTV KNYFITDAQT GSSKVCVSI DILLDDFVEI LK---SQDLS

	7025 7035 7045 7055 7065 7075
EMCR	VISKVHEVII DNKPYRWMLW CKDNHLSTFY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
229E	VISKVHEVII DNKPYRWMLW CKDNHLSTFY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
PEDV	VISKVHEVII DNKPYRWMLW CKDNHLSTFY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
TGEV	VISKVHEVII DNKPYRWMLW CKDNHLSTFY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
OV43	CVSKVNVNVN DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPVLYK YLNSPMERVS
BoCoV	CVSKVNVNVN DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPVLYK YLNSPMERVS
MHV	CVSKVNVNVN DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPVLYK YLNSPMERVS
AIBV	NKSKVTVTSI DYHSINFMTW FEDGSIKTCY POLQS-AWT CGYAMPQIYK VQNCVMEPCN
SARS CoV	VISKVHEVII DYAEISFMLW CKDGHVETFY PKLQASQAWK PGVAMPNLYK MQRMCLPCN

	7085	7095	7105	7115	7125	7135
EMCR	LYNYGAGIKL	PSGIMLNVRK	YTQLCQYLNS	TTMCVPHNMR	VHLYGAGSDK	GVAPGTTVLK
229E	LYNYGAGLKL	PSGIMFNVRK	YTQLCQYFNS	TTLCVPHNMR	VHLYGAGSDY	GVAPGTAVLK
PEDV	LYNYGAGVKL	PDGIMFNVRK	YTQLCQYLNS	TTMCVPHNMR	VHLYGAGSDK	GVAPGTAVLR
TGEV	LYNYGAQVKL	PDGITTNVRK	YTQLCQYLNT	TTLCVPHKMR	VHLYGAGSAS	GVAPGSTVLR
OV43	LWNYGKPVTL	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNMR	VHLYGAGSEK	GVAPGSAVLR
BoCoV	LWNYGKPVTL	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNTR	VHLYGAGSEK	GVAPGSAVLR
MHV	LWNYGKPITL	PTGCLMNVAK	YTQLCQYLNT	TTLAVPANMR	VHLYGAGSDK	DVAPGSAVLR
AIBV	IPNYGVGITL	PSGILMNVAK	YTQLCQYLSK	TTICVPHNMR	VHLYGAGSDK	GVAPGSTVLK
SARS CoV	LQNYGENAVI	PKGIMMNVAK	YTQLCQYLNT	LTAVPYNMR	VHLYGAGSDK	GVAPGTAVLR

	7145	7155	7165	7175	7185	7195
EMCR	RWLPPD----	-----AIII	DNDINDVYSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--
229E	RWLPHD----	-----AIVV	DNDVVDYVSD	ADFSVTGDCA	TVYLEDKFDL	LISDMYDG--
PEDV	RWLPLD----	-----AIIV	DNDSDYVSD	ADYSVTGDCA	TVYLEDKFDL	LISDMYDG--
TGEV	RWLPPD----	-----AIIV	DNDSDYVSD	ADYSVTGDCA	TVYLEDKFDL	LISDMYDG--
OV43	QWLPAG----	-----TILV	DNDLYPFVSD	SVATYFGDCI	TLFPDCQWDL	IISDMYDP--
BoCoV	QWLPAGTILR	QWLPAGTILV	HNDLYPFVSD	SVATYFGDCI	TLFPDCQWDL	IISDMYDP--
MHV	QWLPAG----	-----SILV	DNDINPFVSD	SVASYGNCI	TLPIACQWDL	IISDMYDP--
AIBV	QWLPEG----	-----TLLV	DNDIVDYVSD	AHVSVLSDCN	KYNTHEKFDL	VISDMYTDND
SARS CoV	QWLPTG----	-----TLLV	DSLDNDFVSD	ADSTLIGDCA	TVHTANKWDL	IISDMYDP--

	7205	7215	7225	7235	7245	7255
EMCR	--RIKFCDGE	NVSKDGFFTY	LNGVIREKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL
229E	--RTKADIGE	NVSKDGFFTY	INGFICEKLA	IGGSIAIKVT	EYSWNKLYE	LVQRFATWTL
PEDV	--KIKSCDGE	NVSKDGFFTY	INGVITEKLA	LGGTVAIKVT	EFSWNKLYE	LIQRFATWTL
TGEV	--STKSIDGE	NTSKDGFFTY	INGFIKEKLS	LGGSVAIKIT	EFSWNKLYE	LIQRFATWTL
OV43	--ITKNIGEY	NVSKDGFFTY	ICHMIRDKLA	LGGSVAIKIT	EFSWNAELK	LMGYFAFWTV
BoCoV	--LLLDIGVH	VVRCS--YI	HCHMIRDKLA	LGGSVAIKIT	EFSWNAELK	LMGYFAFWTV
MHV	--LTKNIGEY	NVSKDGFFTY	LCHLIRDKLA	LGGSVAIKIT	EFSWNAELK	LMGYFAFWTV
AIBV	SKRKHEGVIA	NNGNDDVFIY	LSSFLRNKLA	LGGSVAIKIT	ETSWHEVLYD	IAQDCAWWTM
SARS CoV	--RTKHVTKE	NDSKGFFTY	LCGFIKQKLA	LGGSVAIKIT	EHSWNADLYK	LMGHFSWWTA

	7265	7275	7285	7295	7305	7315
EMCR	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFIA	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
229E	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFID	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
PEDV	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFID	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
TGEV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
OV43	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
BoCoV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
MHV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
AIBV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
SARS CoV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF

	7325	7335	7345	7355	7365
EMCR	ECKHKATVVV	TLKDSVDNDM	VLSLIKSGRL	LLRNSGRFGG	FSNHLVSTK-
229E	NCKHKATVVV	QLKDSINEM	VLSLVRSGKL	LVRNGKCLSL	FSNHLVSTK-
PEDV	NCKHKATVVV	NLKDSISDV	VLGLLKNGKL	LVRNDAICG	FSNHLVSTK-
TGEV	KCRNNALIV	NLKEKELNEM	VIGLLRKGKL	LVRNDAICG	FSNHLVSTK-
OV43	PLKLAGTAVI	NLRADQINDM	VYSLLEKGL	LIRDTNKEVF	VGDSLNVNVI-
BoCoV	EIPQFGTGVL	IACLIWLNRS	LSWLMP----	-----	-----
MHV	PLKVAGTAVV	SLKPDQINDL	VLSLIEKGL	LVRDTRKEVF	VGDSLNVNVI-
AIBV	DLRLKATPVV	NLKEKELNEM	VIGLLRKGKL	LVRDTRKEVF	VGDSLNVNVI-
SARS CoV	PLKLRGTAVM	SLKENQINDM	IYSLLEKGL	IIRENNRVVV	SSDIHVNN--

E. Putative Spike protein

	5	15	25	35	45	55
EMCR S	---MKLFLL	LLILP---	L VSCFSTC---	-----	SNASIS---	-----ML
229E S	---	---	---	---	---	---
PEDV	MRSLLYFWLL	LPVLP---	T LSLPQDV---	-----	RCQSTTNF---	-----RRFFS
TGEV	---MKKLFVV	LVVMP---	L IYGNFP---	-----	SKLTNRITGN	QWNLIETFL
CaCoV	---MIVLTLC	LFLFL-YSSV	SCTSNND---	-----	C VQVNVTLQPG	NENIIRDFLF
FeCoV	---MIVLVTC	LLLLCSYHTV	LSTTNNE---	-----	C IQVNVTLQAG	NENLIRDFLF
Por Resp C	---MKKLFVV	LVVMP---	L IYG---	-----	---	---
OC43	---MFLIL	LISLPTAFV	IGDLKCTSDT	SYINDKDTGP	PPISTDTVDV	TNGLGTYIVL
BoCoV	---MFLIL	LISLPTAFV	IGDLKCT--T	VSINDVDVTA	PSISTDIVDV	TNGLGTYIVL
MHV	---MLFVF	LTLLPSSSLGY	IGDFRCIQ-L	VNTDTSNASE	PSVSTEVDV	SKGIGTYIVL
Rat CoV	---MLFVF	LTLLPSSSLGY	IGDFRCIN-L	VNTRISNARA	PSVSTEVDV	SKGIGTYIVL
PHEV	---MFFIL	LISLPSAFV	IGDLKCT--T	SLINDVDVTV	PSISSEVDV	TNGLGTFYVL
AIBV	---	---	---	---	---	---
SARS	---MFIFLL	FLTLTSG---	SDLDR---	-----	-CTTFDDVQA	PNYTQHTSSM
	65	75	85	95	105	115
EMCR S	QLG--VPDNS	STIVTGLLP-	---VHWICAN	QSTSSYPANG	FFYIDVG-KH	RSAFALHSGY
229E S	---	---	---	---	---	---
PEDV	KFN--VQAPA	VVVLGGYLP	MNSSSWYCGT	GIETASGVHG	IFLSYIDSGQ	GFEIGISQEP
TGEV	NYSSRLPPNS	DVVLGDYFPT	--VQFWNCI	RNDSNOLYVT	LENLKALYWD	YATENITWN-
CaCoV	QN---FKEEG	SLVVGYYYP-	--TEVWYNC	TQQTAYKY	FSNIHAFYFD	MEAMENSTGN
FeCoV	SN---FKEEG	SVVVGYYYP-	--TEVWYNC	RTARTAFQY	FNNIHAFFYV	MEAMENSTGN
Por Resp C	---	---	---	---	---	---
OC43	DR---VYLNT	TLFLNGYYPT	SGSTYRNMAL	RGSVLLSRLW	FKPPFLSDFI	NGIFAKVKNT
BoCoV	DR---VYLNT	TLLNGYYPT	SGSTYRNMAL	KGTLLLSRLW	FKPPFLSDFI	NGIFAKVKNT
MHV	DR---VYLNA	TLLTGYYPV	DGSMYRNMAL	TGINTISLW	YKPPFLSEFN	DGIFAKVKNL
Rat CoV	DR---VYLNA	TLLTGYYPV	DGSMYRNMAL	MGTNTLSLW	FEPPFLSEFN	DGIYAKVKNL
PHEV	DR---VYLNT	TLLNGYYPI	SGATFRNMAL	KGTRLLSTLW	FKPPFLSPFN	DGIFAKVKNS
AIBV	---	---	---	---	---	---
SARS	RG---VYYPD	EIFRSDTLYL	TQDLFLPFYS	NVTGFHTINH	TFGNPVIPEK	DGIYFAATEK
	125	135	145	155	165	175
EMCR S	YDANQYIYL	TNKIH----	-----	LNAPVTLKIC	KFGN-----	---TSFDLFS
229E S	---	---	---	---	---	---
PEDV	FDPGQYQLYL	HKATNG----	-----	N TNAIARLRIC	QFPDN-----	---KTLGPTVN
TGEV	-HRQRLNVVV	NGYPYSITV-	-----	TTRN FNSAEGAIIC	ICKGSPPTTT	TESSLTCNWG
CaCoV	ARGKPLLVHV	HGNPVSIIIV	ISAYRDDVQF	RPLKHLGLLC	ITKN--DTVD	YNSFTTNQWR
FeCoV	ARGKPLLEHV	HGEPVSIIIV	-SAYRDDVQF	RPLKHLGLVC	ITKN--RHIN	YEFTSNQWN
Por Resp C	---	---	---	---	---	---
OC43	KVIKDRVMYS	EFPAITIG--	-----	STF VNTSYSVVVQ	PRTINSTQDG	YNKLQGLLEV
BoCoV	KVIKGVVMYS	EFPAITIG--	-----	STF VNTSYSVVVQ	PHTTN-----	L DNKLQGLLEI
MHV	KASLPKDSIS	YFPTIIIG--	-----	SNF VTTSYTVVLE	PYN-----	---GIIMA
Rat CoV	KASLPKDSIS	YFPTIIIG--	-----	SNF VNTSYTVVLE	PYN-----	---GIIMA
PHEV	RFSKDGVIYS	EFPAITIG--	-----	STF VNTSYSIVVE	PHTSL-----	I NGNLQGLLQI
AIBV	---	---	---	---	---	---
SARS	SNVVRGWVFG	STMNKSQS-	-----	VII INNSTNVVIR	ACN-----	FEL CDNPFPAVSK
	185	195	205	215	225	235
EMCR S	NVSTSHDCIV	NLSFTEQL--	GVPLGITISG	ETVRLHLYNA	TRTFYVPAAY	KLTKLSVKCY
229E S	---	---	---	---	---	---
PEDV	DVTTRGNCLF	NKAIAYMRD	GKDIVVGITW	DNDRVTVF-A	DKIYHFYLN	DWSRVATRCY
TGEV	SECR-LNHKF	PICPSNSEAN	CGNMLYGLQW	FADEVVAYLH	GASYRISFEN	QWSGTVTFGD
CaCoV	DICLGDDRKI	PFSVPTDN-	-GTKLFGLEW	NDDYVTAYIS	DESHRLNINN	NWFNNVTLLY
FeCoV	STCTGADRKI	PFSVIPTDN-	-GTKIYGLEW	NDDYVTAYIS	GRSYHLNINT	NWFNNVTLLY
Por Resp C	---	---	---	---	---	---
OC43	SVCQYNMCEY	PQTICHPNLG	--NHRKELWH	LDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
BoCoV	SVCQYTMCEY	PHTICHPKLG	--NKRVELWH	WDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
MHV	SICQYTICQL	PYTDCPKNTG	G-NKLIGFWH	TELKSPVCIL	KRNFTFNVNA	EWLYFHFYQ-
Rat CoV	SICQYTICQL	PHTDCKPNTG	G-NKLIGFWH	TDLRPPVCIL	KRNFTFNVNA	EWLYFHFYQ-
PHEV	SVCQYTMCEY	PHTICHPNLG	--NQRIELWH	YDTPVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
AIBV	---	---	---	---	---	---
SARS	PMGTQHTMI	FDNAFNCTFE	YISDAFSLDV	SE-KSGNFKH	LREFVFNKND	GFLYVYKG--

	245	255	265	275	285	295
EMCR S	FSSECVF---	SVVNA---	-T-ITVNVTT	LNGRIVNYTV	COD---CNGY	TDNIFSVQOD
229E S	-----	-----	-----CQT	TNGLNTSYSV	CNG---CVGY	SENVFAVESG
PEDV	NRRSCAM---	QYVYTP	TY-YMLNVTS	AGEDGIYYEP	CTAN---CTGY	AANVFATDSN
TGEV	MRATTLEVAG	TLVDLWVFN	VYDVSYYRVN	NKNGTTVVSN	CTD---QCASY	VANVFTTQPG
CaCoV	SRTSTATWQH	S--AAYVYQG	VSNFTYYKLN	KTAGLKSVEL	CEDYEYCTGY	ATNVFAPTS
FeCoV	SRSSTATWEY	S--AAYAYQG	VSNFTYYKLN	NTNGLKTYEL	CEDYEHCCTGY	ATNVFAPTS
Por Resp C	-----	-----	-----TSVVS	CTD---QCASY	VANVFTILPG	
OC43	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---MALS	HYVVMPLTCN
BoCoV	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---TVLS	HYVVLPLTCS
MHV	QGG-----	-----	-TFYAYYADV	SSATTFLFSS	YIG---DVL	QYFVLPYMC
Rat CoV	QGG-----	-----	-TFYAYYADV	SSATTFLFSS	YIG---AVLT	QYFVLPYMC
PHEV	EGG-----	-----	-TFYAYFTDT	GFVTKFLFNL	YLG---TVLS	HYVVMPLTCN
AIBV	S-----	-----	---YVYVYQS	AFRPPSGWHL	QGG---AYAV	VNISSEFNNA
SARS	YQP-----	-----	IDVVRDLPSG	FNTLKPIFKL	PLG-INITNF	RAILTAFA
	305	315	325	335	345	355
EMCR S	GRIPNGFPFN	NWFL-LTNGS	TLVDGVSRLY	QPLRLTCLWP	VPGLKSSSTGF	VYFNATGSDV
229E S	GIYPSDFAFN	NWFL-LTNTS	SVVDGVVRSF	QPLLLNCLWS	VSGLRFTTGF	VYFNGTG-RG
PEDV	GHIPEGFSFN	NWFL-LSNDS	TLHLGKVVS	QPLLVNCLLA	IPKIYGLGQF	FSFNHTM-DG
TGEV	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVT	QPLLVNCLWP	VPSFEAAST	FCFEGAG-FD
CaCoV	GIYPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQE	FCFEGAQ-FS
FeCoV	GIYPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQE	FCFEGAQ-FS
Por Resp C	GFIPSDFSFN	NWFL-LTNSS	TLVNGKLVT	QPLLVNCLWP	VPSFEAAST	FCFEGAD-FD
OC43	SKVKNGTLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
BoCoV	S-----	AMTLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ
MHV	LTITGVFSPO	YVVTPLVSRQ	YLFNFNQGI	ITSADVDCASS	YTSEIKCKTQ	SMNPNTG-VY
Rat CoV	PTTSVSSPO	YVVTPLVSRQ	YLFNFNQGI	ITSADVDCASS	YTSEIKCKTQ	SMNPNTG-VY
PHEV	S-----	ALSLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ
AIBV	G-----	SSS	GCTVGIHGG	RVVNASSIAM	TAPSSGMAWS	SSQFCTAHN
SARS	QIOWGTSAAA	YFVGYLKPTT	FMLKYDENG	ITDAVDCSQN	PLAELKCSVK	SFEIDKG-IY
	365	375	385	395	405	415
EMCR S	NCGNQHNSV	ADVMYRNLNL	SANSVDNLKS	GVIVFKTLQY	-DVLFCYCN-	--SS-SGVLD
229E S	DCCKGFSSDV	SDVIRYNLNF	EEN---LRR	GTLFCKTSYG	-VVVFCYCN-	--NT-LVSGD
PEDV	VNGAAVDRA	PEALRFNIND	TSV---ILAE	GSIVLHTALG	TNLSFVCSN-	--SSDPLAI
TGEV	QCNGAVLNNT	VDVIRENLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCY--	TVSDSSFFSY
CaCoV	QCNGAVLNNT	VDVIRENLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCYND	TVSESSFFSY
FeCoV	QCNGAVLNNT	VDVIRENLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCYSD	TVSESSFFSY
Por Resp C	QCNGAVLNNT	VDVIRENLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCYND	TVSDSSFFSY
OC43	ELNGYTVQPI	ADVYRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSCNCF	NMSSLMSFIQ
BoCoV	ELNGYTVQPI	ADVYRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSCNCF	NMSSLMSFIQ
MHV	DLSGYTVQPV	GLVYRRVRL	PDCKIEEWLT	AKSVPSPLNW	ERKTFQNCNF	DLSSLLRFVQ
Rat CoV	DLSGYTVQPV	GLVYRRVRL	PDCKIEEWLT	AKSVPSPLNW	ERKTFQNCNF	DLSSLLRFVQ
PHEV	ELNGYTVQPV	ATVYRRPDL	PNCNIEAWLN	SKTVSSPLNW	ERKTFSCNCF	NMSSLMSFIQ
AIBV	CYKHGGCPLT	GMLQONLIRV	SAMKNGQLFY	NLTVSVAKYP	TFRSFQCVN-	--NLTSVYLN
SARS	QTSNFRVVP	GDVVRFPNIT	NLCPFGEVEN	ATKFPSSVYAW	ERKKISNCVA	DYSVLVNSTF
	425	435	445	455	465	475
EMCR S	TTIPFGPSSQ	PYYCFINSTI	NTTHVSTFVG	ILPPTVREIV	VARTGQFYIN	GFKYFDLGEI
229E S	AHIPFGTVLG	NFYCFVNTTI	GNETTSAFVG	ALPKTVREFV	ISRTGHFYIN	GKRYFTLGNI
PEDV	FAIPGATEV	PYYCFKVDOT	YNSTVYKFLA	VLPPTVREIV	ITKYGDVYVN	GFGYLHLGLL
TGEV	GEIPFGVTDG	PRYCYV---H	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
CaCoV	GEIPFGVTDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
FeCoV	GEIPFGVTDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
Por Resp C	GEIPFGVTDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
OC43	ADSFCTNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIOTTTATS
BoCoV	ADSFCTNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIOTTTATS
MHV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNSRRVDLQ	LGKSGLLQSF	NYKIDTRATS
Rat CoV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNSRRVDLQ	LGKSGLLQSF	NYKIDTRATS
PHEV	ADSFCTNNID	ASRLYG--MC	FGSITIDKFA	IPNSRKVDLQ	VGKSGYLQSF	NYKIDTAVSS
AIBV	GDVYTSNET	IDVTSAG--V	YFRAGGPITY	KVMREVKALA	YFVNGTAQDV	ILCDGSPRGL
SARS	FSTFCYGV	ATKLND--LC	FSNVYADSEV	VKGDDVRQIA	PGQTGVIA	NYKLDPDDFMG
	485	495	505	515	525	535
EMCR S	EAVNFNVNT--	TASATDFW	TVAFATFVDV	LVNVSATNIQ	NLLYCDSPFE	KLQCEHLQFG
229E S	EAVNFNVNT--	TAETTDFC	TVALASYADV	LVNVQSSTIA	NIIYCNSVIN	RLRCDQLSFD
PEDV	DAVTINFTGH	GTDDVSGFW	TIASTNFVDA	LIEVQGTISI	RILYCDOPVS	QLKCSQVAFD
TGEV	DCISFNLT--	TGDSDFVW	TIAYTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
CaCoV	DCIAFNLT--	TGASGAFW	TIAYTSYTEA	LVQVENTAIK	KVTYCNSHIN	NIKCSQITAN
FeCoV	DCISFNLT--	TGVSAGFW	TIAYTSYTEA	LVQVENTAIK	NVTYCNSHIN	NIKCSQITAN
Por Resp C	DCISFNLT--	TGDSDFVW	TIAYTSYTEA	LVQVENTAIT	NVTYCNSVIN	NIKCSQITAN
OC43	CQLYNNLP--	AAVSVS	RFPSTWNR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
BoCoV	CQLYNNLP--	AAVSVS	RFPSTWNR	EGFTEQVFK	PQPVGVTHH	DVYVYQHCFK
MHV	CQLYNSLA--	KNNVTVN	NHNPSSWNR	YGFND----	-VATFGTGKH	DVAYAEACFT
Rat CoV	CQLYNSLA--	KNNVTVI	NHNPSSWNR	YGFND----	-VATFHSGEH	DVAYAEACFT
PHEV	CQLYNSLP--	AAVSVT	HNPSSWNR	YGFNN----	-QSFGSRGLH	DAVYVYQHCFK
AIBV	LACQNTG--	NFSDGFI	PFTNSSLVKQ	KFIVYR----	---ENSVNT	TCTLHNFIFH
SARS	CVLAWNTR--	-----NID	ATSTGMYNYK	YRRLR----	---HG-----	-----

	545	555	565	575	585	595
EMCR S	LQDGFY--SA	--NFLDDNVL	P-----ET	YVALPIYYQH	TDINFATA-	--SFGGSCYV
229E S	VPDGFY--ST	--SPIQSVEL	P-----VS	IVSLPVYHKH	TFIVLYVDFK	PQSGGGKCFN
PEDV	LDDGFYPISS	--RNLLSHEQ	P-----IS	FVTLPSFNDH	SFVNITVSA-	--AFGG-LSS
TGEV	LNNGFYPVSS	--SEVG--LV	N-----KS	VVLLPSFYTH	TIVNITIGLG	-MKRSGYGQP
CaCoV	LQNGFYPVAS	--SEVG--LV	N-----KS	VVLLPSFYSH	TSVNITIDLG	-MKRS-VTVT
FeCoV	LNNGFYPVAS	--SEVG--FV	N-----KS	VVLLPSFETY	TAVNITIDLG	-MKLSGYGQP
Por Resp C	LNNGFYPVSS	--SEVG--SV	N-----KS	VVLLPSFLTH	TIVNITIGLG	-MKRSGYGQP
OC43	APKNFCPCKL	NGS-CVSGSP	G-----KNNG	IGTCPAGTNY	LTCDN-----	-----LC
BoCoV	APKNFCPCKL	DGSLCVGNP	GIDAGYKNSG	IGTCPAGTNY	LTCHNAA----	-----QCDCIC
MHV	VGASYCPCAN	P-SIVSPCTT	G-----K-PN	FANCPTGTSN	RECTVMPLAN	-NQFKCDCTC
Rat CoV	VGASYCPCAK	P-STVYSCVT	G-----K-PK	SANCPTGTSN	RECNVQASG-	-FKSKDCTC
PHEV	TPNTYCPCRT	--SQCIG---	G-----AG	TGTCPVGTTV	RKCFAAVTK-	--ATKCTCWC
AIBV	NETGANPNPS	-----	-----G	VQNIQTYQTK	TAQSGYYNFN	-----FSF
SARS	---KLRPFER	-----	-----D	ISNVFFSPDG	KPCTP-----	-----

	605	615	625	635	645	655
EMCR S	CKPRQVNISL	N-----GNTSV	CVRTSHFSIR	YIYNRVKSGS	P-----G	DSSWHIYLKS
229E S	CYPAGVNITL	ANFNETKGPL	CVDTSHTTK	YVAVYANVG-	-----	--RWSASINT
PEDV	ANLVASDITI	N-----GFSSE	CVDTRQFTIT	LFYNVTNSYG	-----	---YVSKSQD
TGEV	IASTLSNITL	PMQDHNIDVY	CIRSDQFSVY	VHSTCKSALW	DNIFKRNCID	VLDATAVIRT
CaCoV	IASPLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNNFNACTD	VLDATAVIRT
FeCoV	IASTLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNIFNQDCTD	VLEATAVIRT
Por Resp C	IASTLSNITL	PMQDNNIDVY	CIRSDQFSVY	VHSTCKSVLW	DNVFKRNCID	VLDATAVIRT
OC43	TPDPITFKAT	GTYPKCPQTKS	LVGIGEHCSG	LAVKSDYCGG	-----N	SCTCRPQAFI
BoCoV	TPDPITSKST	GPYKCPQTKY	LVGIGEHCSG	LAIKSDYCGG	-----N	PCTCQPQAFI
MHV	NPSPLTTYDL	--R-CLQARS	MLGVGDHCEG	LGVLEDKCGG	S-----N	TCNCSAHAFV
Rat CoV	NPSPLTTYDP	--R-CLQARS	MLGVGDHCEG	LGILEDKCGG	S-----N	ICNCSADAFV
PHEV	QPDPSYKGV	NAWTCPQSKV	SIQPGQHCPG	LGLVEDDCSG	-----N	PCTCKPQAFI
AIBV	LSSFVYKESN	FMYGSIHPSC	KFRLETINNG	LWFNSLSVS-	-----	---IAYGPIQ
SARS	-----	-----P--AL	NCYWLNDY-	-----G	-----	---FYTTTGI

	665	675	685	695	705	715
EMCR S	GTCPFSSFKL	NNFQKFKTIC	FSTVEVPGSC	NFPLEATW--	HYTSYTVIGA	LYVTWSEGNS
229E S	GNCPFSFGKV	NNFVKFGSVC	FSLKDIPGGC	AMPIVANW--	AYSKYTTIGS	LYVSWSDGOG
PEDV	SNCPFTLQSV	NDYLSFSKFC	VSTSLLAGAC	TIDLFYGP--	AFGSGVKLTS	LYFOFTKGEL
TGEV	GTCPFSSFDKL	NNYLTFNKFC	LSSLSPVGANC	KFDVAAR--	TRTNEQVVRS	LYVIIEEGON
CaCoV	GTCPFSSFDKL	NNYLTFNKFC	LSSLSPVGANC	KLDVAAR--	TRTNEQVFGS	LYVIIEEGON
FeCoV	GTCPFSSFDKL	NNYLTFNKFC	LSSLSPVGANC	KFDVAAR--	TRTNEQVVRS	LYVIIEEGON
Por Resp C	GTCPFSSFDKL	NNYLTFNKFC	LSSLSPVGANC	KFDVAAR--	TRTNDQVVRS	LYVIIEEGDS
OC43	GWSADSCLOQ	DKCNIFANFI	LHDVNSGLTC	STDLOKANTD	IILGVCVNYD	LYGILGQGIF
BoCoV	GWSVDSCLQG	DRCNIFANFI	FHDVNSGTTT	STDLOKSNTO	IILGVCVNYD	LYGITGQGIF
MHV	GWAKDCLAN	GRCHIFSNNL	LNGINSGLTC	SMDLQLPNTE	VVTGVCVKYD	LYGITGQGIF
Rat CoV	GWAMDSCLN	ARCHIFSNNL	LNGINSGLTC	STDLOLPNTE	VVTGVCVKYD	LYGSTGQGVF
PHEV	GWSETCLQN	GRCNIFANFI	LNDVNSGTTT	STDLOQGNIT	ITTDVCVNYD	LYGITGQGIL
AIBV	GGCKGSVFKG	RATCCYAYS	GGPSLCKGVY	SGELDHN--	---FECGLLV	YVTKSGGSRI
SARS	GYQYRVVVL	S----FELLN	APATVCGPKL	STDLIKN--	---QCVNFN	FNELTGTG-V

	725	735	745	755	765	775
EMCR S	ITGVPPVPSG	IREFSNLVLN	NCTKYNIYDY	VGTGIIRSSN	QSLAGGITYV	S-----
229E S	ITGVPPQVEG	VSEFNNVTLD	KCTKYNIYDV	SGGVIVRVSN	DTFLNGITYT	S-----
PEDV	ITGTPKPLEG	ITDVSFMTLD	VCTKYTIYGF	KGEGITLTN	SSILAGVYIT	S-----
TGEV	IVGVPSDMSG	VHDLVLHLHD	SCTDYNIIYGR	TGVGIIRQTN	RTLLSGLYIT	S-----
CaCoV	IVGVPSDMSG	LHDLVLHLHD	SCTDYNIIYGR	TGVGIIRKTN	STLLSGLYIT	S-----
FeCoV	IVGVPSDMSG	LHDLVLHLHD	SCTDYNIIYGR	TGVGIIRRTN	STLLSGLYIT	S-----
Por Resp C	IVGVPSDMSG	LHDLVLHLHD	SCTDYNIIYGR	TGVGIIRQTN	RTILSGLYIT	S-----
OC43	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
BoCoV	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
MHV	KEVKADYYNS	WQNLLYDVNG	NLYGFRDFVA	NKSYTIRSCY	SGRVSAAYHQ	D-----
Rat CoV	KEVKADYYNS	WQNLLYDVNG	NLYGFRDIYT	NKTYLLRSCY	SGRVSAAYHQ	D-----
PHEV	IEVNATYYNS	WQNLLYDSNG	NLYGFRDYLS	NRTFLIRSCY	SGRVSAVFHA	N-----
AIBV	QTATEPPVIT	QNNYNNITLN	TCVDYNIYGR	TGQGFITNVT	DSAVSYNYLA	DAGLAILDTS
SARS	LTPSSKRFPQ	FQQFGRDVS	FTDSVADPRT	SEILDISPCS	FGGVSUITPG	TN-----A

	785	795	805	815	825	835
EMCR S	NSGNLLGFKN	VSTGNI FIVT	PCNQPDQAV	YQQ-SIIGAM	TAVNESRYGL	QNLLQLPNEY
229E S	TSGNLLGFKD	VTKGTIYSIT	PCNPPDQLV	YQQ-AVVGAM	LSNETSYGF	SNVVELPKFF
PEDV	DSGQLLAFKN	VTSGAVYSVT	PCSFSQAAY	VND-DIVGVI	SSLSNS--TF	NNTRELPGFF
TGEV	LSGDLGFKN	VSDGVIYSVT	PCDVSAQAAV	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
CaCoV	LSGDLGFKN	VSDGVVYSVT	PCDVSAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
FeCoV	LSGDLGFKN	VSDGVIYSVT	PCDVSAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
Por Resp C	LSGDLGFTN	VSDGVIYSVT	PCDVSAQAAI	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
OC43	SSEPALLFRN	IKCNYVFENN	LTRQLQPINY	FDS-YLGCVV	NAYNSTAISV	QTCDLTVGSG
BoCoV	SSEPALLFRN	IKCNYVFENN	LSRQLQPINY	FDS-YLGCVV	NADNSTSSV	QTCDLTVGSG
MHV	APEPALLYRN	LKCDYVFENN	ISREETPLNY	FDS-YLGCVV	NADNSTEEAV	DACDLRMGSG
Rat CoV	APEPALLYRN	LKCDYVFENN	ISREETPLNY	FDS-YLGCVI	NADNSTEQSV	DACDLRMGSG
PHEV	SSEPALLFRN	LKSHVFENN	ILRQLQLVNY	FDS-YLGCVV	NAYNNTASAV	STCDLTVGSG
AIBV	GSIDIFVQGG	EYGLNYYKVN	PCEDVNQQFV	VSGGKLVGIL	TSRNETGSOL	LENQFYIKIT
SARS	SSEAVLYQD	VNCTDVSTAI	HADQLTPAWR	IYS-TGNVNF	QTAGCLIGA	EHVDTSYECD

	845	855	865	875	885	895
EMCR S	YVS-----NG	GNN-----	-----CTTAV	MIYSNFGICA	DGSLIPVRPR	NSSDNGISAI
229E S	YAS-----NG	TYN-----	-----CTDAV	LTYSSEFGVCA	DGSIIAVQPR	NVSYDSVSAI
PEDV	YHS-----ND	GSN-----	-----CTEPV	LVYSNIGVCK	SGSIGYV-PS	QYGVQVRIAPT
TGEV	YYSI---YNY	TNDRTGTAI	DSNDVDCEPV	ITYSNIGVCK	NGAFVFIN-V	THSDGDVQPI
CaCoV	YYSI---YNY	TNMNRGTAI	D-NDIDCEPI	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
FeCoV	YYSI---YNY	TSERTGTAI	DSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
Por Resp C	YYSI---YNY	TNDKTRGTPI	GSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
OC43	YCVD---YSK	NRR-----	-----SRGAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
BoCoV	YCVD---YST	KRR-----	-----SRRAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
MHV	LCVN---YST	SHR-----	-----ARSSV	STGYKLTTFE	PFTVRIVN--	---DSVESVD
Rat CoV	LCVN---YSI	AHR-----	-----ARRSV	STGYKLTTFE	PFTVSIVN--	---DSVESVG
PHEV	YCVD---YVT	ALR-----	-----SRRSF	TTGYRFTNFE	PFAANLVN--	---DSIEPVG
AIBV	NGTRFRRSI	TEN-----	-----VANCYP	VSYGKFCIKP	DGSIATIVPK	QLEQFVAPLF
SARS	IPIG---AGI	CAS-----	-----YHTVSL	LRSTSQKSIV	AYTMSLG---	---ADSSIAY
	905	915	925	935	945	955
EMCR S	-ITANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCATYVCNGN	PRCKNLLKQY	TSACKTIEDA
229E S	-VTANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCSTYVCNGN	VRCEVELLKQY	TSACKTIEDA
PEDV	-VTGNISIPT	NFSMSIRTEY	LQLYHTPVSV	DCATYVCNGN	SRCKQLLTQY	TAACKTIESA
TGEV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCKNLLTQY	VSACQTIEQA
CaCoV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCARYVCNGN	PRCKNLLTQY	VSACQTIEQA
FeCoV	-STGNVTIPT	NFTISVQVEY	MQVYTPVSI	DCARYVCNGN	PRCKNLLTQY	VSACQTIEQA
Por Resp C	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCKNLLTQY	VSACQTIEQA
OC43	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
BoCoV	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
MHV	-GLYELQIPT	NFTIASHQEF	VQTRSPKVTI	DCAAFVCGGH	TACRQQLVEY	GSFCDNINAI
Rat CoV	-GLYEMQIPT	NFTIASHQEF	IQTRSPKVTI	DCAAFVCGDY	TACRQQLVDY	GSFCDNINAI
PHEV	-GLYEIQIPS	EFTIGNLEEF	IQTRSPKVTI	DCATFVCGDY	AACRQQLAEY	GSFCENINAI
AIBV	NVTENVLIPN	SFNLTVTDEY	IQTRMDKVQI	NCLQYVCGSS	LDCRKLFOQY	GPVCDNLSV
SARS	-SNNTIAIPT	NFSISITTEV	MPVSMAKTSV	DCNMYICGDS	TECANLLLOY	GSFCTQLNRA
	965	975	985	995	1005	1015
EMCR S	LRLSAHLETN	DVSSMLTFDS	NA-FSLANVT	SFG-----D	YNLSSVLPO-	-----
229E S	LRNSARLESA	DVSEMLTFDR	KA-FTLANVS	SFG-----D	YNLSSVIPS-	-----
PEDV	LQLSARLESV	EVNSMLTISE	EA-LQLATIS	SFNG-----DG	YNFTNVLGAS	-----
TGEV	LAMGARLENM	EVDSMLEFSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
CaCoV	LAMGARLENM	EIDSMLEFSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PNIGGSWLEG
FeCoV	LAMGARLENM	EVDSMLEFSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PSIGGSWLEG
Por Resp C	LAMGARLENM	EVDSMLEFSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
OC43	LTEVNELLDT	TOLQVANSML	NG-VTLSTKL	KDGVNFNVD	INFSPVLGCL	G-----
BoCoV	LTEVNELLDT	TOLQVANSML	NG-VTLSTKL	KDGVNFNVD	INFSPVLGCL	G-----
MHV	LGEVNNLIDT	MLQVQASALI	QG-VTLSSRL	SDGIGGQIDD	INFSPLLGCL	G-----
Rat CoV	LGEVNNLIDT	MLQVQASALI	QG-VTLSSRL	ADGIGGQIDD	INFSPLLGCL	G-----
PHEV	LTEVNELLDT	TOLQVANSML	NG-VTLSTKI	KDGINFNVD	INFSPVLGCL	G-----
AIBV	VNSVGQKEDM	ELLNFYSSTK	PAGFNTPVLS	NVSTG-----E	FNISLLLTN-	-----
SARS	LSGIAAEQDR	NTRVFAQVK	QM-YKPTLK	YFG-----G	FNFSQILPDP	-----
	1025	1035	1045	1055	1065	1075
EMCR S	---RNIHSS	RIAGRSAIED	LLFSKVVTSG	LGTVDVDYKS	CTKGLS--IA	DLACAQYNG
229E S	---LPTSGS	RVAGRSAIED	ILFSKLVTS	LGTVDVDYK	CTKGLS--IA	DLACAQYNG
PEDV	V---YDPASGR	VQKRSVIED	LLFNKVVTNG	LGTVDVDEYKR	CSNGRS--VA	DLVCAQYNG
TGEV	LKYILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
CaCoV	LKDILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	SAGGYD--IA	DLVCARYNG
FeCoV	LKDILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
Por Resp C	LKYILPSDNS	KRYRSIAIED	LLFSKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
OC43	-SECSKASS-	---RSAIED	LLFDKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
BoCoV	-SACNKVSS-	---RSAIED	LLFSKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
MHV	-SDCSEGTKA	AQ-GRSAIED	VLFDKVKLSD	VG-FVEAYNN	CTGGQE--VR	DLICVQSFNG
Rat CoV	-SDCSEGTKA	AQ-GRSAIED	VLFDKVKLSD	VG-FVESYNN	CTGGQE--VR	DLICVQSFNG
PHEV	-SECNRAST-	---RSAIED	LLFDKVKLSD	VG-FVQAYNN	CTGGAE--IR	DLICVQSYNG
AIBV	-----PSSRR	K---RSLIED	LLFSTVESVG	LP-TNDAYKN	CTAGPLGFFK	DLACAREYNG
SARS	-----LKPTK-	---RSFIED	LLFNKVTLAD	AG-FMKQYGE	CLGDIN--AR	DLICAQKFNG
	1085	1095	1105	1115	1125	1135
EMCR S	IMVLPGVADA	ERMAMYTGS	IGGMVLGGLT	S-----AAAI	FSLALQARLN	YVALQTDVLQ
229E S	IMVLPGVADA	ERMAMYTGS	IGGIALGGLT	S-----AVSIP	FSLALQARLN	YVALQTDVLQ
PEDV	IMVLPGVADA	EKLHMYASL	IGGMALGGIT	A-----AAALP	FSAVAVQARLN	YVALQTDVLQ
TGEV	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG-----AVAI	FAVAVQARLN	YVALQTDVLN
CaCoV	IMVLPGVAND	DKMTMYTASL	TGGITLGALS	GG-----AVAI	FAVAVQARLN	YVALQTDVLN
FeCoV	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG-----AVAI	FAVAVQARLN	YVALQTDVLN
Por Resp C	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG-----AVAI	FAVAVQARLN	YVALQTDVLN
OC43	IKVLPPLLSE	NQISGYTLAA	TSASLFLPWT	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
BoCoV	IKVLPPLLSE	NQISGYTLAA	TSASLFLPWS	A-----AVGVP	FYLNQYRIN	GLGVTMDVLS
MHV	IKVLPPLLSE	NQISGYTAGA	TASAMFPWS	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
Rat CoV	IKVLPPLLSE	NQISGYTAGA	TASAMFPWS	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
PHEV	IKVLPPLLSE	NQISGYTLAA	TAASLFPWT	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
AIBV	LLVLPPIITA	EMQALYTSSL	VASMAFGGIT	A-----AGAI	FATQLOARLN	HLGITQSLLL
SARS	LTVLPPLLTD	DMIAAYTAAL	VSGTATAGWT	FGAGAAQIP	FAMQAYRIN	GIGVTQNVLY

	1145	1155	1165	1175	1185	1195
EMCR S	ENQKILAAAF	NKAINNIVAS	FSSVNDIAITH	TAEAIHTVTI	ALNKIQDVVN	QOGSALNHLT
229E S	ENQKILAAAF	NKAMTNIVDA	FTGVNDIAITQ	TSQALQTVAT	ALNKIQDVVN	QOGSALNHLT
PEDV	RNQQLLAESF	NSAIGNITSA	FESVKEAISQ	TSKGLNTVAH	ALTKVQEVVN	QOGSALNHLT
TGEV	KNQKILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	IQGQALSHLT
CaCoV	KNQKILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	TQGQALSHLT
FeCoV	KNQKILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSQGLATVAK	ALAKVQDVVN	TQGQALSHLT
Por Resp C	KNQKILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLTTVAK	ALAKVQDVVN	TQGQALRHLT
OC43	QNQKLIANAF	NNALYAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
BoCoV	QNQKLIANAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
MHV	ENQKMIASAF	NNAIGAIQEG	FAATN-----	-----S	ALAKMQFVVN	ANAEALNNLL
Rat CoV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKIQSVVN	ANAEALNNLL
PHEV	QNQKLIASAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
AIBV	KNQEKIAASF	NKAIGHMQEG	FRSTS-----	-----L	ALQKIQDVVS	QQSAILTETM
SARS	ENQKQIANOF	NKAISQIQES	LTTTS-----	-----T	ALGKLQDVVN	QNAQALNTLV

	1205	1215	1225	1235	1245	1255
EMCR S	SQLRHNFQAI	SNSIHAIYDR	LDSIQADQVQ	DRLITGRLLA	LNAFVSQVLN	KYTEVRGSR
229E S	SQLRHNFQAI	SSSIQAIYDR	LDTIQADQVQ	DRLITGRLLA	LNVFVSHTLT	KYTEVRASRQ
PEDV	VQLQHNFQAI	SSSIDDIYSR	LDILSADVQV	DRLITGRLLA	LNAFVAQTTL	KYTEVQASRK
TGEV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTTL	RQAEVRSRQ
CaCoV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTTL	RQAEVRSRQ
FeCoV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTTL	RQAEVRSRQ
Por Resp C	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTTL	RQAEVRSRQ
OC43	QQLSNRFGAI	SASLQELLSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
BoCoV	QQLSNRFGAI	SASLQELLSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
MHV	QQLSNRFGAI	SASLQELLSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DMTLVKVSAA
Rat CoV	QQLSNRFGAI	SASLQELLSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DMTLVKVSAA
PHEV	QQLSNRFGAI	SASLQELLSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
AIBV	ASLKNKFGAI	SSVIQEIYQQ	FDALQANAQV	DRLITGRLLS	LSVLASAKQA	EYIRVVSQRE
SARS	KQLSSNFGAI	SSVNDILSR	LDKVEAEVQI	DRLITGRLLS	LQTVYVQQLI	RAAEIRASAN

	1265	1275	1285	1295	1305	1315
EMCR S	LAQKINECV	KSQSNRYGFC	G-NGTHIFSI	VNSAPDGLLF	LHTVLLPTDY	KNVKAWSGIC
229E S	LAQKINECV	KSQSKRYGFC	G-NGTHIFSI	VNAAPEGLVF	LHTVLLPTQY	KDVEAWSGLC
PEDV	LAQKINECV	KSQSQRYGFC	GGDGEHIFSL	VQAAPOGLLF	LHTVLLVPGDF	VNVLAIAGLC
TGEV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWPGIC
CaCoV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
FeCoV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
Por Resp C	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
OC43	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPGLYF	IHFSYVPTKY	VTARVSPGLC
BoCoV	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPGLYF	IHFSYVPTKY	VTARVSPGLC
MHV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPGLYF	IHFSYVPTSF	TTANVSPGLC
Rat CoV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPGLYF	IHFSYVPTSF	TTANVSPGLC
PHEV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPGLYF	IHFSYVPTKY	VTARVSPGLC
AIBV	LATQKINECV	KSQSIYRIFC	G-NGRHVLT	PQNPAPGIVF	IHFSYTPDSF	VNVTAIVGFC
SARS	LAATKMSECV	LQSKSRVDFC	G-KGYHLMSE	PQAPPHGVVF	LHVTYVPSQE	RNFTTAPAI

	1325	1335	1345	1355	1365	1375
EMCR S	VDG-----IYG	YVLQPNLVL	YS-----DN	GVFRVTSRVM	FQPRLPVLS	FVQIYNCNVT
229E S	VDG-----TNG	YVLQPNLAL	YK-----EG	NYRITSRIM	FEPRIPTMAD	FVQIENCNVT
PEDV	VNG-----EIA	LTLREPGLVL	FTHELQTYTA	TEYFVSSRRM	FEPKPTVSD	FVQIESCVVT
TGEV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
CaCoV	ASDG-SRTFG	LVVEDVQLTL	FRN-----LD	EKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
FeCoV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
Por Resp C	ALDV-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
OC43	IAG-----DRG	IAPKSGYFVN	VN-----	NWMTYTGSGY	YYPEPITENN	VVMSTCAVN
BoCoV	IAG-----DRG	IAPKSGYFVN	VN-----	NWMTYTGSGY	YYPEPITENN	VVMSTCAVN
MHV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
Rat CoV	ISG-----DRG	LAPKAGYFVQ	DH-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
PHEV	IAG-----DIG	ISPKSGYFVN	VN-----	NSWMTGSSY	YYPEPITQNN	VVMSTCAVN
AIBV	VKPANASQYA	IVPANGRGIF	IQVN-----	GSYYITARDM	YMPRAITAGD	VVTLTSCQAN
SARS	HEG-----KA	YFPREGVFVF	NG-----	TSWFITQRNF	FSPQIITTDN	TFVSGNCDVV

	1385	1395	1405	1415	1425	1435
EMCR S	FVNISRVELH	TVIP-DYVDV	NKTLQEFQAN	L-PKYVKNPF	DLTPFNLTYL	NLSSELKQLE
229E S	FVNISRSELQ	TVIP-EYIDV	NKTLQELSYK	L-PNYTVPDL	VVEQYNQTL	NLTSEISTLE
PEDV	YVNLTSQQLP	DVIP-DYIDV	NKTLQELILAS	L-PNRTGPSL	PLDVFNATYL	NLTGEIADLE
TGEV	FVNATVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TFDIFNATYL	NLTGEIDDL
CaCoV	FVNGTVIELP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	PLDIFNATYL	NLTGEINDLE
FeCoV	FVNATVIDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDIFNATYL	NLTGEIDDL
Por Resp C	FVNATVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDVFNATYL	NLTGEIDDL
OC43	YTKAPYVMLN	TSIP-NLPDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
BoCoV	YTKAPDVMNL	ISTP-NLHDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
MHV	YTKAPEVFLN	TSIP-NLPDF	KEELDQWFKN	QTSIAPDLSL	DY--INVTF	DLQVEMN---
Rat CoV	YTKAPEVFLN	TSIP-NLPDF	KEELDQWFKN	QTSIAPDLSL	DY--INVTF	DLQVEMN---
PHEV	YTKAPDMLN	TSTP-NLPDF	KEELYQWFKN	QSSVAPDLSL	DY--INVTF	DLQVEMN---
AIBV	YYSVNTKITV	TFVDNDDFD	NDELSKWWDN	T--KHELPDF	DKFNVTVPIL	DIDSEID---
SARS	IGIINTVYD	PLQP-ELDSF	KEELDQWFKN	HTSPDVLG	ISG-INASVV	NIQREID---

	1445 1455 1465 1475 1485 1495
EMCR S	AKTASLFQTT VELQGLIDQI NSTYVDLKL NREFENYIKWP WVVWLIISVV FVVLSSLVLF
229E S	NKSAELNYTV QKLQTLIDNI NSTLVDLKL NRVETIYIKWP WVVWLCISVV LIFVVSMLLL
PEDV	QRSESLRNTT EELRSLINNI NNTLVNLEWL NRVETIYIKWP WVVWLIIVIV LIFVVSLLVF
TGEV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
CaCoV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPILLF
FeCoV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
Por Resp C	FRSEKLHNTT VELAILIDNI NNTVNVLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
OC43	----- -RLQEAIRVL NQSYINLKDI GTYEYVVKWP WYVWLLICLA GVAMLVLLFF
BoCoV	----- -RLQEAIRVL NQSYINLKDI GTYEYVVKWP WYVWLLIGFA GVAMLVLLFF
MHV	----- -RIQDAIKKL NESYINLKDV GTYEMYVKWP WYVWLLIGLA GVAVCVLLFF
Rat CoV	----- -RIQDAIKKL NESYINLKDI GTYEMYVKWP WYVWLLIGLA GVAVCVLLFF
PHEV	----- -RLQEAIRVL NQSYINLKDI GTYEYVVKWP WYVWLLIGLA GVAMLVLLFF
AIBV	----- -RIQGVIIQGL NQSLIDLEKL SILKTIYKWP WYVWLAIAFA TIIIFILIGW
SARS	----- -RLNEVAKNL NESLIDLQEL GKYEYIYKWP WYVWLGFIAG LIAIVMVTIL

	1505 1515 1525 1535 1545
EMCR S	CCLSTGCCGC CNCLTSSMRG CCDCGSKLP YYFEKVVHVQ -----
229E S	CCCSTGCCGF FSCFASSIRG CCES--TKLP YYDVEKIHQ -----
PEDV	CCISTGCCGC CGCCGACFSG CCRG-PRLOP YEAFEKVVHVQ -----
TGEV	CCCSTGCCGC IGCLGSCCHS ICSR-RQFEN YEPIEKVVHV -----
CaCoV	CCCSTGCCGC IGCLGSCCHS ICSR-GQFES YEPIEKVVHV -----
FeCoV	CCFSTGCCGC IGCLGSCCHS ICSR-RQFEN YEPIEKVVHV -----
Por Resp C	CCCSTGCCGC IGCLGSCCHS IFSR-RQFEN YEPIEKVVHV -----
OC43	ICCTG-CG- -TSCFKKCGG CDDYTGYQE LVIKT---SH DD-----
BoCoV	ICCTG-CG- -TSCFKICGG CDDYTGHQE LVIKT---SH DD-----
MHV	ICCTG-CG- -SCCFKKCGN CCDECGGHQD SIVIHNISSH ED-----
Rat CoV	ICCTG-CG- -SCCFKKCGN CCDEYGGQA GIVIHNISSH ED-----
PHEV	ICCTG-CG- -TSCFKKCGG CDDYTGHQE FVIKT---SH DD-----
AIBV	VFFMTGCCGC CCGCFGIMPL MSKCGKSSY YTTFDNDVVT EQYRPKKS
SARS	LCCMTSCCS- -CLKGACSCG SCCKFDEDD S EPVLKGVKLH YT-----

f. Putative Orf 4a

	5 15 25 35 45 55
EMCR 4a	MPFGLFQLT LESTINKSVA NLKLPPHDVT VLRDNLKPVT TLSTITAYLL VSLFVTFYFAL
229E 4a	MALG-LFTLQ LVSANQSL S NAKVSAEVS R QVIQDVKDG T VTFNLAYTL MSLFVVYFAL

	65 75 85 95 105 115
EMCR 4a	FKPLTARGRV ACFVLKLLTL SVYVPLLVL F GMYLDSFIIF FLRCCFDSYM LAIMPISNKN
229E 4a	FKARSHRGRA ALIVEKILIL FVYVPLLYW S QAYIYATLIA VILLG-RFFH TAWHCWLYKT

	125 135 145 155 165 175
EMCR 4a	FSFVLFNVTK LCFVSGKWCY LEQSFYENRF AAIYGGDHYV VLGGETITFV SFDDLYVAIR
229E 4a	WDFIVFNVTT LCYAR-----

	185 195 205 215 225
EMCR 4a	GSCEKNLQLM RKVDLYNGAV IYIFAEPPV GIVYSSQLYE DVPSIN
229E 4a	-----

g. Putative Orf 4ab

	5 15 25 35 45 55
EMCR 4a	MPFGGLEFQLT LESTINKSVA NLKLPPHDVT VLRDNLKPVT TLSTITAYLL VSLFVTFYFAL
229E 4a	MALG-LFTLQ LVSAVNQSL S NAKVSAEVS R QVIQDVKDG T VTFNLLAYTL MSLEVVYFAL
229E 4b	-----

	65 75 85 95 105 115
EMCR 4a	FKPLTARGRV ACFVLKLLTL SVYVPLLVL F GMYLDSFIIF FLRCCFDSYM LAIMPISNKN
229E 4a	FKARSHRGRA ALIVFKILIL FVYVPLLYWS QAYIYATLIA VILLG-RFFH TAWHCWLYKT
229E 4b	-----

	125 135 145 155 165 175
EMCR 4a	FSFVLNVNVT LCFVSGKWCY LEQSFYENRF AAIYGGDHYV VLGGETITFV SFDDLYVAIR
229E 4a	WDFIVFNVT LCYAR-----
229E 4b	-----MQGKCW FLENKALKPF VCFYGGDQFL YIGDRIVSYF STNDLYVALR

	185 195 205 215 225
EMCR 4a	GSCEKNLQLM RKVDLYNGAV IYIFAEPPV GIVYSSQLYE DVPSIN
229E 4a	-----
229E 4b	GRIDKDL SLS RKVELYNGEC VYLFCEHPAV GIVNTDFKLE IH....

h. Putative Orf E

	5 15 25 35 45 55
EMCR E	----MFLRLI DDNG-IVLNS ILWLLVMIFF F-VLAMTFIK LIQLCFTCHY FFSRTLYQP-
229E	----MFLKL V DDHA-LVVNV LLWCVVLI VI L-LVCITIIK LIKLCFTCHM FCNRTVYGP-
PEDV	----MLQLV DDNG-LVVNV ILWLFVLFEL L-IISITFVQ LVNLCFTCHR LCNSAVYTP-
TGEV	MTFPRALTVI DDNG-MVINI IFWFLLIIL I-LLSIALLN IIKLCMVCCN LGRTVIVP-
CaCoV	MTFPRALTVI DDNG-MVISI IFWFLLIIL I-LFSIALLN IIKLCMVCCN LGRTVIVP-
FeCoV	MTFPRAFTII DDHG-MVVSF FFWLLLIIL I-LFSIALLN VIKLCMVCCN LGKTIIVLP-
Por Resp C	MTFPRALTVI DDNG-MVISI IFWFLLIIL I-LLSIALLN IIKLCMVCCN LGRTVIVP-
OC43	--MFADAYL ADTV-WYVGQ IIFIVAICLL VTIVVVAFLA TFKLCIQLCG MCNTLVLS-
BoCoV	--MFADAYF ADTV-WYVGQ IIFIVAICLL VTIVVVAFLA TFKLCIQLCG MCNTLVLS-
PHEV	--MFADAYL ADTV-WYVGQ IIFIVAICLL VTIVVVAFLA TFKLCIQLCG MCNTLVLS-
MHV	----MENLFL TDTV-WYVGQ IIFIVAVCLM VTIVVVAFLA SIKLCIQLCG LCNTLLSP-
Rat CoV	----MENLFL IDTV-WYVGQ IIFIVAVCLM VTIVVVAFLA SIKLCIQLCG LCNTLLSP-
AIBV	--MNLLNKSL EENG-SFLTA LYIIVGFLAL Y-LLGRALQA FVQAADACCL FWYTWVVI
SARS	----MYSFVS EETGTLIVNS VLLFLAFVVF L-LVTLAILT ALRLCAYCCN IVNVSIVKFP-

	65 75 85 95 105
EMCR E	---VYKIFL- -----AYQDYM --QIAPV-PA EVLNV-----
229E	---IKNVYH- -----IYQSYM --HIDPF-PK RVIDF-----
PEDV	---IGRLYR- -----VYKSYM --RIDPL-PS TVIDV-----
TGEV	---AQHAYD- -----AYKNFM --RIKAYNPD GALLA-----
CaCoV	---ARHAYD- -----AYKNFM --QIRAYNPD EALLV-----
FeCoV	---ARHAYD- -----AYKTFM --QTKAYNPD EAFLV-----
Por Resp C	---VQHAYD- -----AYKNFM --RIKAYNPD GALLV-----
OC43	---SIYVFNR GR-----QFYEFYN --DVKPP-VL DVDDV-----
BoCoV	---SIYVFNR GR-----QFYEFYN --DVKPP-VL DVDDV-----
PHEV	---SIYVFNR GR-----QFYEFYN --DVKPP-VL DVDDV-----
MHV	---SICVYNR SK-----QLYKYNN E-EVRPP-PL EVDDIIQTL-
Rat CoV	---SIYVYNR SK-----QLYKYNN E-EVRPP-PL EVDDIIQTL-
AIBV	AKGTAFVYKY TYGRKLNNPE LEAVIVNEFP KNGWNNKNPA NFQDAQRDKL YS
SARS	---TVVYVS- -----RVKNLN --SSEGV-PD LLV-----

i. Putative Orf M (Matrix protein)

	5	15	25	35	45	55
EMCR	-----	-----	-----	-----	-----	-M SNSS-----
229E	-----	-----	-----	-----	-----	-M SNDN-----
PEDV	-----	-----	-----	-----	-----	-M SNGS-----
TGEV	-----	-----	-----MK	ILLILACVIA	CACGERYCAM	KSDTDLSCRN
CaCoV	-----	-----	-----MKK	ILFLACAIA	CVYGERYCAM	TESS-TSCRN
FeCoV	MHMPPIRPLC	KPRHIPTKH	FWFELNKKY	ILLILACIIA	CVYGERYCAM	QDSG-LQCIN
PRCoV	-----	-----	-----MK	ILLILACAIA	CTCGERYCAM	KDDTGLSCRN
OC43	-----	-----	-----	-----	-----	-M SSKT-----
PHEV	-----	-----	-----	-----	-----	-M SSPT-----
BoCoV	-----	-----	-----	-----	-----	-M SSVT-----
MHV	-----	-----	-----	-----	-----	-M TSTTQ-----
RatSAV	-----	-----	-----	-----	-----	-M SSTTP-----
AIBV	-----	-----	-----	-----	-----	-M PNETN-----
SARS	-----	-----	-----	-----	-----	-M ADNG-----

	65	75	85	95	105	115
EMCR	-----V	PLSEVYVHLR	NWNFSWNLL	TVFIVVLQYG	HYKYSRLLYG	LKMSVWLWCLW
229E	-----C	-TGDIVTHLK	NWNFGWNVL	TIFIVILQFG	HYKYSRLFYG	LKMLVLWLLW
PEDV	-----I	PVDEVIEHLR	NWNFTWNIL	TILLVVLQYG	HYKYSVFLYG	VKMAILWLW
TGEV	STASDCESCF	NGGDLIHLA	NWNFSWSIIL	IVFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
CaCoV	STAGNCASCF	ETGDLIHLA	NWNFSWSVIL	IIFITVLQYG	RPQFSWFVCG	IKMLIMWLLW
FeCoV	GTNSRCQTCF	ERGDLIHLA	NWNFSWSVIL	IVFITVLQYG	RPQFSWLVYG	IKMLIMWLLW
PRCoV	GTASDCESCF	NRGDLIHLA	NWNFSWSIIL	IIFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
OC43	--TPAPVYIW	TADEAIKFLK	EWNFSLGIIL	LFITIIILQFG	YTSRSMFVYV	IKMIILWLMW
PHEV	--TPVPVISW	TADEAIKFLK	EWNFSLGIIV	LFITIIILQFG	YTSRSMFVYV	IKMVILWLMW
BoCoV	--TPAPVYTW	TADEAIKFLK	EWNFSLGIIL	LFITIIILQFG	YTSRSMFVYV	IKMIILWLMW
MHV	--APQPVYQW	TADEAIRFLK	EWNFSLGIIL	LFVTIILQFG	YTSRSMFVYV	VKMILLWLMW
RatSAV	--APQTVYQW	TADVAVRFLK	EWNFLLGIIL	LFITIIILQFG	YTSRSMFIYV	VKMIILWLMW
ATBV	-----CTL	DFEQSVQLFK	EYNLFITAFI	LFLTIILQYG	YATRSKVIYT	LKMIVLWCFW
SARS	-----TI	TVEELKQLE	QWNLVIGFLF	LAWIMLLQFA	YSNRNRFYI	IKLVFLWLLW

	125	135	145	155	165	175
EMCR	PLVLALSIFD	CFVNFNVND-W	VFFGFSILMS	IITLCLWVMY	FVNSFRLWRR	VKTEWAFNPE
229E	PLVLALSIFD	TWANWDSN-W	AFVAFSFFMA	VSTLVMWVMY	FANSFRLFRR	ARTEWAWNPE
PEDV	PLVLALSIFD	AWASFQVN-W	VFFAFSILMA	CITLMLWIMY	FVNSIRLWRR	THSWWSFNPE
TGEV	PVVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
CaCoV	PIVLALTIFN	AYLEYRVSRY	VMFGFSVAGA	TVTTFILWIMY	FVRSIQLYRR	TKSWWSFNPE
FeCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSVAGA	VVTFALWMMY	FVRSVQLYRR	TKSWWSFNPE
PRCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
OC43	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSFWSFNPE
PHEV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWVYV	FVNSIRLFIR	TGSWWSFNPE
BoCoV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSWWSFNPE
MHV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIMWIMY	FVNSIRLFIR	TGSWWSFNPE
RatSAV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIMWIMY	FVNSIRLFIR	TGSWWSFNPE
AIBV	PLNIAGVIS	--CTYPPN-T	GGLVAAIILT	VFACLSFVG	WQISIRLFKR	CRSWWSFNPE
SARS	PVTLACFVLA	--AVYRIN-W	VTGGIAIAMA	CIVGLMWLSY	FVASFRLFAR	TRSMWSFNPE

	185	195	205	215	225	235
EMCR	TNAIISLQVY	-GHNYLPPVM	AAPTGVTLTL	LSGVLLVDGH	KIATRVQVGQ	LPKYVIVATP
229E	VNAITVTTL	-GQTYYPQIQ	QAPTGITVTL	LSGVLYVDGH	RLASGVQVHN	LPEYMTVAVP
PEDV	TDALLTTSVM	-GRQVCIPVL	GAPTGVTLTL	LSGTLVVEGY	KVATGVQVQS	LPNFVTVAKA
TGEV	TKAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
CaCoV	TSAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
FeCoV	TNAILCVNAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KMAGGLTIEH	LPKYVMIATP
PRCoV	TNAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMTIDN	LPKYVMVALP
OC43	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLSD	LPAYVTVAK-
PHEV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLSD	LPAYVTVAK-
BoCoV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYMQGI	KLGTGYSLSD	LPAYVTVAK-
MHV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATI	IRGHLYMQGV	KLGTGYSLSD	LPAYVTVAK-
RatSAV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATN	VRGHLYMQGV	KLGTGYSLSD	LPAYVTVAK-
AIBV	SNAYGSLLT	NGQOCNFAIE	SVPMVLSPII	KNGVLYCEGQ	WLAK-CEPDH	LPKDFVCTP
SARS	TNILLNVPLR	-GTIVTRPLM	ESELVIGAVI	IRGHLRMAGH	PLGR-CDIKD	LPKEITVAT-

	245	255	265	275	285	
EMCR	STTIVCDRVG	RSVNETSQTG	WAFYVRKXHG	DFSGVASQEG	VLSEREKLLH	LI
229E	STTIIVSRVG	RSVNSQNSTG	WVFYVRVKHG	DFSAVSSPMS	NMTENERLLH	FF
PEDV	TTTIVYGRVG	RSVNASSGTG	WAFYVRSKHG	DYSAVSNPSA	VLTDESEKVLH	LV
TGEV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLH	MV
CaCoV	VRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
FeCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
PRCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLH	MV
OC43	VTHLCTYKRG	FLDRISDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
PHEV	VTHLCTYKRG	FLDRIGDTSG	FAVYVKSAG	NYRLPSTHKG	SGMDTALLRN	NI
BoCoV	VSHLLTYKRG	FLDKIGDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
MHV	VSHLCTYKRA	FLDKVDGVS	FAVYVKSAG	NYRLPSN-KP	SGMDTALLR-	-I
RatSAV	VSHLCTYKRA	FLDKVDGVS	FAVYVKSAG	NYRLPSN-KP	SGADTALLR-	-I
AIBV	DRRNIIYRMVQ	KYTGQDSGNK	KRFATFVYAK	QSVDTGELES	VATGGSSTLYT	--
SARS	SRTLSYYKLG	ASQRVGTDSG	FAAYNRYRIG	NYKLNTDHAG	SDNIALLVQ	--

j. Putative Orf N (Nucleoprotein)

	5	15	25	35	45	55
EMCR	-----	--MAS----	----VN---W	ADDR-----	--AARKKF--	-----
229E	-----	--MAT----	----VK---W	ADASEPQ---	--RGRQGR--	-----
PEDV	-----	--MAS----	----VS---F	QDRG-----	--RKR-----	-----
TGEV	-----	--MANQGQR-	----VS---W	GDESTKT---	--RGRSNSRG	RKNNN----
FeCoV	-----	--MATQGQR-	----VN---W	GDEPSKR---	--RGRSNSRG	RKNND----
PRCoV	-----	--MANQGQR-	----VS---W	GDESTKI---	--RGRSNSRG	RKINN----
CaCoV	-----	--MASQGQR-	----VS---W	GDESTKR---	--RGRSNSRG	RKNND----
RSDACoV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERGQNN	GNGRRRNQPK	QTATTQ-PNT
MHV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERG---	-NRRRRNHFK	QTATTQ-PNA
PHEV	MSFTPGKQSS	-SRASSGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRVQSK	QTATSQQPSG
OC43	MSFTPGKQSS	-SRASSGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRAQPK	QTATSQQPSG
BoCoV	MSFTPGKQSS	-SRASFGRNS	GNGILK---W	ADQSDQSRNV	QTRGRRAQPK	QTATSQPLPSG
SARS	-----	--MSDNGPQS	NQRSAPRITF	GGPTSDTDNN	QNGRRNGARP	KQRRPQ----
AIBV	-----	--MASG----	----K---A	AGKTDAPAPV	IKLGGPKPPK	VGSS-----

	65	75	85	95	105	115
EMCR	----PPPSFY	MPLLVSSDKA	PYRVIPRNLV	PIKGKNG-DE	QIGYWNVQER	--WRMRRGQR
229E	----IPYSLY	SPLLVDSE-Q	PWKVIPRNLV	PINKKDK-NK	LIGYWNVQER	--FRTRKGRK
PEDV	----VPLSLY	APLRVTNDKP	LSKVLANNV	PTNKGKNG-DQ	QIGYWNEQIR	--WRMRRGQR
TGEV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
FeCoV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
PRCoV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
CaCoV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
RSDACoV	GSVVPYHSWF	SGITQFQKQK	EFQFAGGQGV	PIANGIPPSE	QKGYWYRHNR	RSFKTPDGGQ
MHV	GSVVPYHSWF	SGITQFQKQK	EFQFAGGQGV	PIASGIPASE	QKGYWYRHNR	RSFKTPDGGQ
PHEV	GTVPYYSWF	SGITQFQKQK	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
OC43	GNVVPYYSWF	SGITQFQKQK	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
BoCoV	GNVVPYYSWF	SGITQFQKQK	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
SARS	GLPNNTASWF	TALTQHGK-E	ELREFPRGQV	PINTNSGPD	QIGYRRRATR	R-VRGGDGKM
AIBV	----GNASWF	QAIAKAKLNT	PPPKFEGSGV	PDNENIKPSQ	QHGYYRRQAR	--FKPGKGGR

	125	135	145	155	165	175
EMCR	VDLPPKVFHY	YLGTPGHKDL	KFRQRSDGVV	WVAKEGAKTV	NTSLGNRK--	RNQPPEPKF
229E	VDLSPKLHXY	YLGTPGHKDA	KFRERVEGVV	WVAVDGAKTE	PTGYGVRR--	KNSEPEIPHF
PEDV	IEQPSNWHFY	YLGTPGHGDL	RYRTRTEGVF	WVAKEGAKTE	PTNLGVRR--	ASEKPIIPKF
TGEV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGSRG--	ANNESKALKF
FeCoV	KELAERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGTRG--	TNNEKPLRF
PRCoV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGSRG--	ANNESKALKF
CaCoV	KNLPEKWFFY	YLGTPGHADA	KFKDKLDGVV	WVARGDSMTK	PTTLGTRG--	TNNEKALKF
RSDACoV	KQLLPRWYFY	YLGTPGHAGA	SFGDSIEGVF	WVANSQADTN	TSADIVERDP	SSHEAIPTRF
MHV	KQLLPRWYFY	YLGTPGHAGA	EYGDIDGVV	WVASQADTK	TPADIVDRDP	SSHEAIPTRF
PHEV	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
OC43	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
BoCoV	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASNQADIN	TPADILDRDP	SSDEAIPTRF
SARS	KELSPRWYFY	YLGTPGEASL	PYGANKGIV	WVATEGALNT	PKDHIGTRNP	NNNAATVLQL
AIBV	KVPDPDAWYFY	YTGTPGAADL	NWGDQDGVV	WVAAGKADTK	SRSNQTRDP	DKFDQYPLRF

	185	195	205	215	225	235
EMCR	SIALPPPLSV	VEFEDRSNNS	SRASSRSSTR	-----	-----NNSR	DS-----
229E	NQKLPNGVT	VEEPD-----	SRAPSRSQSR	-----	-----SQSR	-----
PEDV	SQQLPSVVEI	VEPNTTP--A	SRANSRSRSR	GNGNRSRSP	SNNRGNNQSR	GNSQNRGNNO
TGEV	DGKVPGEFQL	EVNQ-----	-RDNSRSRSQ	-----	-----	-----
FeCoV	DGKIPPGFQL	EVNRS-----	-RNNSRSRSQ	-----	-----	-----
PRCoV	DGKVPGEFQL	EVNQ-----	-RDNSRSRSQ	-----	-----	-----
CaCoV	DVKVPSEFHL	EVNQL-----	-RDNSRSRSQ	-----	-----	-----
RSDACoV	APGTVLPGGF	YVEGS-----	GRSAPASRS	-----	-----	-----
MHV	APGTVLPGGF	YVEGS-----	GRSAPASRS	-----	-----	-----
PHEV	PPGTVLPGGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
OC43	PPGTVLPGGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
BoCoV	PPGTVLPGGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
SARS	PQGTTLPGGF	YAEGS-----	-RGGSQASSR	-----	-----	-----
AIBV	SDGGPDGNER	WDFIP-----	--LN-RGRSG	-----	-----	-----

	245	255	265	275	285	295
EMCR	SRSTSQR---	-----QSR-	TRSDSNQS--	-----S-SDL	VAAVTLALKN	LGFDN--QSK
229E	GRGESKP---	-----QSRN	PSSDRNHN--	-----SQDDI	MKAVAAALKS	LGFDKP-QEK
PEDV	GRGASQNRGG	NNNNNNKSRN	QSNNRNQSDN	RGGVTSRDDL	VAAVKDALKS	LGIGEN-PDR
TGEV	SRSSRSNR--	-----SQSRG	RQGFNNKK--	-----DDSV	EQAVLAALKK	LGVDTE-KQQ
FeCoV	SRSSRSNR--	-----SQSRG	RHHSNNQ--	-----NNNV	EDITIVAVLEK	LGVT-D-KQ-
PRCoV	SRSSRSNR--	-----SQSRG	RQGSNNKK--	-----DDSV	EQAVLAALKK	LGVTTE-KQQ
CaCoV	SRSSRSNR--	-----SQSRG	RQLSNNKK--	-----DDNV	EQAVLAALKK	LGVDTE-KQQ
RSDACoV	SRSSRSRG--	-----NNRA	RSSSNQRQ--	-----PASTV	KPDMAEEIAA	LVLAN---LG
MHV	SRSSRSRG--	-----NNRA	RSSSNQRQ--	-----PASAV	KPDMAEEIAA	LVLAK---LG
PHEV	SRAPNRAPS-	-----AGSRS	RANSNRT--	-----STPGV	TPDMADQIAS	LVLAK---LG
OC43	SRTSSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
BoCoV	SRASSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
SARS	SSSSRSRG--	-----SRNST	PGSSRGNS--	-----PARMA	SGGGETALAL	LLLDRLNQL
AIBV	-RSTAASS--	-----AAASRA	PSREGSRG--	-----RRSDS	GDDLARAAL	IIQDQ----

	305	315	325	335	345	355
EMCR	SPSSSGTSTP	K-----K-	---PNKPLSQ	PRADKPS---	-QLKKPRWKR	VPTR--EENV
229E	DKKSAKTGTP	KPSRNQSPAS	SQTSAKSLAR	SQSSEKQK	HEMQKPRWKR	QPNDDVTSNV
PEDV	HKQOQPKQKE	K-SDN---SG	KNTPKKNKSR	ATSKERD---	-LKDIPEWRR	IPKG--ENSV
TGEV	QRSRSKSKER	S-----	---NSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
FeCoV	-RSRSKPRER	S-----	---DSKPR	DTTPKNA---	---NKHTWKR	TAGK---GDV
PRCoV	QRSRSKSKER	S-----	---NSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
CaCoV	-RSRSKSKER	S-----	---SSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
RSDACoV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---NKPRQKR	TPNK--QCPV
MHV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---TKPRQKR	TPNK--QCPV
PHEV	-KDATKPKQV	T-----	---KQTAQ	EVROKIL---	---NKPRQKR	SPNK--QCTV
OC43	-KDATKPKQV	T-----	---KHTAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
BoCoV	-KDATKPKQV	T-----	---KQTAQ	EIROKIL---	---NKPRQKR	SPNK--QCTV
SARS	SKVSGKGQQQ	Q-----	---GQTVTK	KSAAEAS---	---KKPRQKR	TATK--QYNV
AIBV	---QKKSRI	T-----	---KAKAD	EMAHRRY---	---CKRT	IPPN---YRV

	365	375	385	395	405	415
EMCR	IQCFFGPRDFN	H---NMGDS	LVQNGVDAKG	FPQLAELIPN	QAALFFDSEV	STDEVG----
229E	TQCFFGPRDL	H---NFGSAG	VVANGVKAKG	YPQFAELVPS	TAAMLFDSHI	VSKEG----
PEDV	AACFFGPRGGF	K---NFGDAE	FVEKGVDAAG	YQIASLAPN	VAALLFGGNV	AVRELA----
TGEV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
FeCoV	TTFYGARSSS	A---NFGD	LVANGNAAKH	YPQLAECVPS	VSSIIFGSQW	SAEEAG----
PRCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
CaCoV	TKFYGARSSS	A---NFGD	LVANGNAAKH	YPQLAECVPS	VSSILFGSHW	TAKEDG----
RSDACoV	QQCFGKRGPN	Q---NFGGPE	MLKLGTSDPQ	FPILAEALPT	PGAFFFGSKL	ELVKKN--SG
MHV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PSAFFFGSKL	ELVKKN--SG
PHEV	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNLSG
OC43	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNLSG
BoCoV	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNLSG
SARS	TQAFGRRGPE	QTQGNFGDQD	LIRQGTQYKH	WPQIAQFAPS	ASAFFGMSRI	GMEVTP----
AIBV	DQVFGPRTKG	K-EGNFGDDK	MNEEGIKDGR	VTAMNLVPS	SHACLFGRSV	TPKLQL----

	425	435	445	455	465	475
EMCR	-----DNV	QITYT---Y	KMLVAKDNKN	LPKFIEQISA	FTKPS-----	SIKEMQSQSS
229E	-----NTV	VLFTT---T	RVTVPKDHHP	LGFLEELNA	FTR-----	EMQQLFLNLP
PEDV	-----DSY	EITYN---Y	KMTVPKSDPN	VELLVQSDA	FKTGN-----	AKLQKKKEKK
TGEV	-----DQI	EVTFT---H	KYHLPKDDPK	TGQFLQIINA	YARPS-----	EVAKEQRKRK
FeCoV	-----DQV	KVTLT---H	TYLPLKDDAK	TSQFLEQIDA	YKRPS-----	EVAKDQQRKR
PRCoV	-----DQI	EVTFT---H	KYHLPKDHHP	TEQFLQIINA	YASPS-----	ELAKEQRKRK
CaCoV	-----DQI	EVTFT---H	KYHLPKDDPK	TGQFLQIINA	YARPS-----	EVAKEQRKRK
RSDACoV	GVDPTKDVY	ELQYSGAVRF	DSTLPGFETI	MKVLNENLNA	YQNOA-----	GGADVSPKP
MHV	GADEPTKDVY	ELQYSGAIRF	DSTLPGFETI	MKVLNENLNA	YQDOA-----	GSVDLVSPKP
PHEV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQHOE-----	DGMNMISPKP
OC43	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQOO-----	DGMNMISPKP
BoCoV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQOO-----	DGMNMISPKP
SARS	-----SGT	WLTYHGAIKL	DDKDPQFQDN	VILLNKHIDA	YKTFP-----	PTEPKKDKKK
AIBV	-----DGL	HLRFETTVV	PCDDPQFQDN	VKICDQCVDG	VGTRPKDDEP	KPKSRSSSRP

	485	495	505	515	525	535
EMCR	HVAQNTVLN-	-----	-ASIPES---	-KPLADDDSA	IIIEIVNEVLH	-----
229E	SALEFNPSQ-	-----	-TSPATA---	-EPVRDEVSI	ETDIIDEVN-	-----
PEDV	NKRETTLQQH	EEAIYDDVGA	PSDVTHANLE	WDTAVDGGDT	AVEIINEIFD	TGN-----
TGEV	SRSKSAERS-	-----	EQDVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
FeCoV	SRSKSADK--	-----	KPEELSVTLV	EAYTDVFDDT	QVEMIDEVTN	-----
PRCoV	SRSKSAERS-	-----	EQEVVPDSLI	ENYTDVFDDT	QVEMIDEVTN	-----
CaCoV	ARSKSVERV-	-----	EQEVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
RSDACoV	QRKRGTQQT-	-AQKEELDSI	SVAKPKSAVQ	RNVSRILTPE	DRSLLAQILD	DGVVPDGLDD
MHV	PRRGRRAQ-	-EKKDEVONV	SVAKPKSLVQ	RNVSRILTPE	DRSLLAQILD	DGVVPDGLDD
PHEV	QRQRGQKN--	--GQVENDNV	SVAAPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
OC43	QRQRGHKN--	--GQENDNI	SVAVPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
BoCoV	QRQRGQKN--	--GQENDNI	SVAAPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
SARS	KTDEAQPLP-	-----	QRQKQPTVT	LLPADMDDF	SRQLQNSMSG	ASADSTQA--
AIBV	ATRGNSPAPR	QQRPKKEKKL	KKQDDEADKA	LTSDEERNNA	QLEFYDEPKV	INWGDAALGE

....

EMCR	----
229E	----
PEDV	----
TGEV	----
FeCoV	----
PRCoV	----
CaCoV	----
RSDACoV	-SNV-
MHV	DSNV
PHEV	TSEI
OC43	TSEI
BoCoV	TSEI
SARS	----
AIBV	NEL-

k. 5'untranslated region (genomic sequence)

	5	15	25	35	45	55
EMCR5'UTR	-----	-----	---AGATAGA	GAATTTTCTT	ATTAGACTT	TGTGTCTACT
229E5'UTR	ACTTAAGTAC	CTTATCTATC	TACAGATAGA	AAAGTTGCTT	-TTTAGACTT	TGTGTCTACT

	65	75	85	95	105	115
EMCR5'UTR	CCTCTCAACT	AAACGAAATT	TTT-CTAGTG	CTGTCAATTG	TTATG--GCA	GTCCTAGTGT
229E5'UTR	TTTCTCAACT	AAACGAAATT	TTTGCTATGG	CCGGCATCTT	TGATGCTGGA	GTCGTAAGTGT

	125	135	145	155	165	175
EMCR5'UTR	AATTGAAATT	TCGTCAAGTT	TGTAA-ACTG	GTTAGGCAAG	TGTTGTATTT	TCTGTGTTTA
229E5'UTR	AATTGAAATT	TCATTGGGGT	TGCAACAGTT	TGGAAGCAAG	TGCTGTGTGT	CCTA-GTCTA

	185	195	205	215	225	235
EMCR5'UTR	AGCACTGGTG	GTTCTGTC-C	ACTAGTGCAC	AC-ATTGATA	CTTAAGT-GG	TGTTCTGTCA
229E5'UTR	AGGGTTTCGT	GTTCCGTGTC	GAGATTCCAT	TCTACAAACG	CCTTACTCGA	GTTCCGTCT

	245	255	265	275	285
EMCR5'UTR	CTGCTTATTG	TGGAAGCAAC	GTTCTGTCTG	TGTGGAAACC	AATAACTGCT
229E5'UTR	CGTGTGTTGT	TGGAAGCAAA	GTTCTGTCTT	TGTGGAAACC	AGTAACTGTT

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